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Checklist of References to Literature on Tropospheric Propagation of UHF, VHF, and SHF Radio Waves (1929 - 1959)

(Supplement #1 to NBS Report 6001)

by

Wilhelm Nupen

NBS

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS
BOULDER LABORATORIES
Boulder, Colorado

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The National Bureau of Standards

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Meteorological Abstracts and Bibliography

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Meteorological Abstracts and Bibliography,
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(15a) Radio Corporation of America. David Sarnoff Research Center, Princeton, N.J. Television: a bibliography of technical papers by RCA authors, 1929-1946. RCA Review, 1946. 10 p. DLC (Z7711.R3) Several of the 275 technical papers as listed in chronological order 1929-1946 will be found to have bearing on aspects of tropospheric propagation.--W.N.

(16a) Robertson, Sloan D. and King, Archie P., The effect of rain upon the propagation of waves in the 1-and 3- centimeter regions. Institute of Radio Engineers, Proceedings, 34(4):178, April 1946. 5 figs., table, 5 refs. Attenuations > 25 db/mi have been observed in rain of cloudburst proportions. Loss is partially offset by greater antenna gains.--W.N.

(17a) Spicklemire, John R. (comp.), Report on German Scientific Library of the BHF (Bevollmächtigte für Hochfrequenzforschung). Germany (Territory under Allied Occupation, U.S.-Zone.). Field Information Agency, Technical, FIAT Final Report, No. 753, March 15, 1946. 256 p. mimeo. DLC--The approximately 2400 selected classified research reports on high frequency technique, communication, radar and related fields, were found May 1945 near Munich by Lt. Davidson of EEIS Team No. 11. Later the collection was evacuated to the London Office of the Technical Liaison Division OCSigO TSFET who made microfilms and abstracts of the reports available to American scientists. These are available at the Joint Intelligence Objectives Agency as well as at the

OCSigO, both in the U.S. War Department, Washington, D.C. The material is arranged under twenty-one major subject headings, each of which is further subdivided. A valuable source of information to the radar engineer as well as to the radar meteorologist. --W.N.

(18a) Waynick, A.H., Ultra-short-wave propagation studies beyond the horizon. Institute of Radio Engineers, Proceedings 35(11):1334, Nov. 1947. 5 figs., 3 refs.

(19a) Millington, G., The reflection coefficient of a linearly graded layer. Marconi Review, 12:140-151, Oct./Dec., 1949. Unchecked.

(20a) Saxton, J.A., Electrical properties of water: reflection characteristics of water surfaces at VHF. Wireless Engineer, 26(312):288-292, Sept. 1949. 5 figs., 2 tables, 17 refs.

1950

(21a) Cheydleur, Raymond D. (comp.), A compilation of radio thesis in American colleges and universities, 1918-1950. Huntington, W. Virginia. Marshall College, Educational Radio, 1950. The 780 papers are listed alphabetically under 44 different subjects and include 150 papers on electrical engineering, 42 on engineering, 1 on engineering mechanics, 5 on engineering and physics, 8 on mathematics and electrical engineering and 44 on physics. There are several papers related to the various aspects of tropospheric propagation here. The multigraphed bibliography include names of the 83 colleges and universities who responded with material and likewise the 43 who did not. --W.N.

(22a) Falkenhagen, Hans, Statistik und Quantentheorie. (Statistics and quantum theory). Zürich, S. Hirzel Verlag, 1950. 272 p. 25 figs., 2 tables, 997 eqs. Debye's dipole theory on parelectrical gases is included (p. 35-37) in the second of the nine chapters which are: (1) Entropy and probability. (2) Classical or Maxwell-Boltzman's statistics. (3) Radiation theory and Planck's quantum theory. (4) Semi-classical model quantum theory. (5) Waves and quantum mechanics. (6) Application of the wave mechanics. (7) Quantum statistics. (8) Nuclear physics. (9) Fundamentals of the electron optic. The index is excellent. --W.N.

(23a) Green, James W., On the deduction of the refractive index profile of a stratified atmosphere from radio field-strength measurements. Institute of Radio Engineers, N. Y., Proceedings, 38(1): 80-88, Jan. 1950. 9 figs., 8 refs., 7 eqs. DLC--This academic discussion on MacFarlane's theory concludes that, except for the possible exception of a limited frequency range under linear lapse rate conditions, the method is too sensitive to permit application directly to experimental data.--W.N.

(24a) Heightman, D.W., Propagation of metric waves beyond optical ranges. British Institution of Radio Engineers, Journal 10:295-311, Oct. 1950. (Listed by title only as No. 212 in preceeding checklist.)

(25a) Saxton, J.A., Reflection coefficient of snow and ice at VHF. Wireless Engineer, 27(316):17-25, Jan. 1950. 13 figs., table, 10 refs., 22 eqs., 2 append. Multiple reflection effects at 300 and 3,000 Mc/s of sea and land ice are theoretically discussed. Reflection coefficients are calculated, and considered for variational influence on transmission dependent on ice conditions.--W.N.

1951

(26a) Crain, Cullen M.; Deam, A.P. and Tolbert, C.W., A preliminary study of the variations in refractive index over a 5000 foot height interval above the earth's surface. Texas. Univ. Electrical Engineering Research Laboratory Report, No. 53, 30 June, 1951. Unchecked.

(27a) Hauer, A., Meteorologische aspecten van de voorplanting in de atmosfeer van zeer korte golven. (Meteorological aspects of very short wave propagation in the atmosphere.) Tijdschrift Nederlandsche Radiogenoot, 16(1):39-52, Jan. 1951. 6 figs., 4 refs., eqs. This lecture, which deals with some practical measurements held against the theory of refraction and scattering related to meteorological factors, was delivered before the Nederlandsche Radiogenootschap, Oct. 1950.--W.N.

(28a) LaGrone, A.H., Some characteristics of tropospheric scattering. Institute of Radio Engineers, Proc., 40(1):106, Jan. 1952. Summary of paper given at IRE-URSI Fall meeting 1951. Unchecked.

(29a) LaGrone, A.H., Benson, W.H., Jr. and Straiton, A.W., Attenuation of radio signals caused by scattering. Journal of Applied Physics. 22:672-674, 1951. Unchecked.

(30a) Saxton, J.A.; Luscombe, G.W. and Bazzard, G.H., The propagation of metre waves beyond the normal horizon, Pt. 2, Experimental investigation at frequency of 90 and 45 Mc/s. Institution of Electrical Engineers, Proc., Pt. 3, 98(55):370-382, 1951. 12 figs., table, 5 refs.

1952

(31a) Fukushima, M.; Tao, K.; Uyesugi, Y. et al, Ultra-short wave propagation and mirage. Journal of Geomagnetism and Geoelectricity, Tokyo, 6(3, 4):141-146, Dec. 1952. Unchecked.

(32a) Hirao, K.; Uyesugi, Y. and Tao, K., Propagation characteristics of VHF over a distance of 125 km. Journal of Geomagnetism and Geoelectricity, Tokyo, 6(3, 4):131-140, Dec. 1952. Unchecked.

(33a) Institute of Radio Engineers--International Scientific Radio Union, Washington, D.C., April 21-24, 1952. (Proceedings). Institute of Radio Engineers, Proceedings, 40(6):738-748, June 1952. IRE-URSI Spring Meeting, Washington, D.C., April 21-24, 1952. Institute of Radio Engineers, Proceedings, 40(6):738-748, June 1952. Summaries of 71 technical papers presented are given. --W.N.

(34a) LaGrone, Alfred H., Volume integration of scattered radio waves. Institute of Radio Engineers, Proceedings, 40(1):54, Jan. 1952. fig., 3 refs., eq.

(35a) Norton, K.A., A formula for the transmission loss of space waves propagated over irregular terrain. US. Nat. Bureau of Standards Report No. 1737, June 16, 1952. Unchecked.

(36a) Saxton, J.A. and Lane, J.A., Electrical properties of sea water. Reflection and attenuation characteristics at VHF. Wireless Engineer, 29(349):269-275, Oct. 1952. 8 figs., 12 refs.

1953

(37a) Ament, W.S., Toward a theory of reflection by a rough surface. Institute of Radio Engineers, Proc., 41(1):142-146, Jan. 1953. Fig., 3 refs., 19 eqs.

(38a) Bussey, Howard E. and Birnbaum, George, Measurement of variations in atmospheric refractive index with an airborne microwave refractometer. U.S. National Bureau of Standards, Journal of Research, 51(4):171-178, Oct. 1953. 7 figs., 2 tables, 16 refs. A microwave refractometer for aircraft use is described, and some of the sources of error in the measurement of variations of atmospheric refractive index with this instrument are discussed. Observations were made up to 10,000 feet on 2 days near Washington, D.C. Two refractive-index soundings taken 1 1/2 hours apart showed changes that, in the coarser aspects, resembled changes shown by radiosonde data. The fluctuation intensity changed erratically with time and place, but was usually greatest where the vertical gradient was changing. A rough analysis of the data showed that the larger fluctuations occured over distances of several hundred meters, whereas over distances less than 5 meters the fluctuations were negligible (the response of the instrument would have allowed the detection of fluctuations occurring within 0.5 meter). Large increases in index were observed on entering cumulus clouds and intense fluctuations were noted within the clouds.--Authors' abstract. (Listed by title only as No. 361 in preceeding checklist.)

(39a) Cornell University, School of Electrical Engineering. High altitude radio frequency propagation study. Its Contract AF19(604)73, Research Report No. EE-165, Sept. 10, 1953. Unchecked.

(40a) Crain, C.M.; Deam, A.P. and Gerhardt, J.R., Measurement of tropospheric index-of-refraction fluctuations and profiles. Institute of Radio Engineers, N.Y., Proceedings, 41(2):284-290, Feb. 1953. 8 figs. DLC--Simultaneous records of index-of-refraction and of temperature fluctuations over the sea and over coastal areas near Lakehurst, N.J., are presented. They were obtained in April 1951 by means of a microwave refractometer and a bead-type thermistor carried by a Navy Type M airship up to 5,000 ft. Index of refraction fluctuations appear to be primarily due to fluctuations in air moisture content. Records showing refractive index profiles and fluctuations are also presented for Dayton, Ohio. These were obtained in June 1951 with a refractometer carried up to 11,000 ft in a Type C-46 aircraft. Some details of the meteorological conditions prevailing during the flights are mentioned, like the fact that whenever rough air was encountered, the index of refraction showed rapid variations of large amplitude, the reverse not being necessarily the case. In general, tropospheric index of refraction fluctuations are found to vary greatly with time and space.--G.T.

(41a) Day, J.P.; Hopkins, R.U.F. and Trolese, L.G., Propagation characteristics of microwave optical links. U. S. Navy Electronics Laboratory, San Diego, Report, No. 409:43-50, 1953. 11 figs. On a 13-mile overwater path in San Diego, San Francisco and Norfolk, Virginia areas fading studies were performed in the 1750 to 1800 Mc range. The results are microfilmed descriptively in this paper. The meteorological profiles given show the radioactive indexes for the entire period of observations. On the San Diego path it was discovered that an earth's radius -1.1 times actual radius yields the observed minima at 17 and 49 ft in the interference pattern. Paths in the San Francisco area had different characteristics from those of San Diego; but both were characteristics of wave interference phenomena and fades. Raysonde observations at Norfolk at about the time of the fades indicated an inversion of about -30 B units between 400 and 800 ft, and a reversal of $\neq$ 30 B units at 7000 ft. --N.N.

(42a) Hamer, E.G., VHF aerial radiation pattern measurements. Electronic Engineering, 25:427-431, Oct., 1953. Unchecked.

(43a) Swarm, H.M., Ghose, R.N. and Keitel, G.H., Tropospheric propagation in horizontally stratified media over rough terrain. Institute of Radio Engineers, Convention Record, Pt. 2-Antennas and Communications: 77-84, 1953. 12 figs., 3 refs., 6 eqs.

(44a) Wickizer, G.S., Field strength of KC"XAK, 534.75 Mc recorded at Riverhead, N.Y. Institute of Radio Engineers, Proc., 41(1):140-141, Jan. 1953. 6 figs., 2 refs. Field strength was recorded for 22 months over a non-optical path at a distance of 33 miles. Over-all variation was approximately 12 db in winter and 33 db in summer, with relatively small variation in the median level. On this transmission path, fading 10 db or more below the median occurred during the summer months and was about evenly divided between daylight and darkness for the normal hours of operation. --Author's Abstract.

1954

(45a) Bailey, V.A., Reflection of waves by an inhomogeneous medium. Physical Review, 96(4):865-868, Nov. 15, 1954. 7 refs. 34 eqs. Theoretical discussion involving a new approximate solution of the general linear second-order differential equation modified here. --W.N.

(46a) Bullington, Kenneth, Reflection coefficients of irregular terrain. Institute of Radio Engineers, Proc., 42(8):1258-1262, Aug., 1954. 6 figs., 3 refs., 11 eqs.

(47a) Cornell University, School of Electrical Engineering. High altitude radio frequency propagation study. A continuation of the investigation of air-to-air and air-to-ground electromagnetic propagation. Its Contract AF19(604)73, Research Report No. EE-225, Sept. 10, 1954. Unchecked.

(48a) Crain, C. M. and Williams, C.E., Refractometer measured tropospheric index of refraction profiles (Southern California Coastal Areas). Texas Univ., Electrical Engineering Research Laboratory, Contract AF19(604)-494, Report No. 6-06, Aug. 16, 1954. Unchecked.

(49a) Davies, H., The reflection of electromagnetic waves from a rough surface. Institute of Radio Engineers, Proc., Pt. IV, 101:209-214, Aug., 1954. Unchecked.

(50a) Deppermann, K. and Franz, W., Theorie der Beugung an der Kugel unter Berücksichtigung der Kriechwelle. (Theory of refraction of spheres with particular consideration to the creeping wave). Annalen der Physik, 6 Folge, Band 14, Heft 6-8:253-264, 1954. 5 figs., 6 refs., 5 eqs. This theoretical paper is based upon excerpts from Depperman's dissertation, and deals with refraction of acoustical and electromagnetic waves of an ideal reflecting sphere as discussed in terms of the integral equations of the refraction theory. The interference of the creeping wave (skin effect) on the geometric reflected wave manifests as intensity maxima and minima of the latter, which is also demonstrated graphically.--W.N.

(51a) Dubin, Maurice, Index of refraction above 20,000 feet. Journal of Geophysical Research, 59(3):339-344, Sept., 1954. 1 table, 7 refs., eqs.

(52a) Franz, Walter, Über die Greenschen funktionen des zylinders und der kugel. (The Green's functions of the cylinder and the sphere). Zeitschrift für Naturforschung, 9a(9):705-716, Sept. 1954. 7 figs., 6 tables, 8 refs., 39 eqs. This theoretical discussion has bearings on the propagation of radio waves through the troposphere. Reference is made to works by Watson and Van der Pol-Bremmer.--W.N.

(53a) Fründt, H.J., Betriebsbereitschaft einer weit hinter den horizont reichenden UKW-Richtverbindung. (Reliability of USW radio link extending far beyond the horizon.) Telefunken Zeitung, 27(103):41-43, March, 1954. 5 figs., 6 refs. Some experiences and results obtained on the non-optical radio link Berlin-Harr at 41 and 68 Mc/s are discussed here.--W.N.

(54a) Ghose, Rabindra Nath, Tropospheric radio propagation beyond the horizon. Ann Arbor, University Microfilms, Publication No. 9072 [1954] . Unchecked.

(55a) Ghose, Rabindra Nath and Albright, W.G., VHF field intensities in the diffraction zone. Institute of Radio Engineers, Transactions, AP-2(1):35-38, Jan., 1954. 3 figs., 8 refs., 20 eqs. Signal strengths are calculated and compared with measured values of this analysis depart from others presented in the variation of form of obtaining a solution to the wave equation. Here is an exponential form which approaches unity at large heights of the distribution of the refractive index. --W.N.

(56a) Herbstreit, J.W.; Rice, P.L. and Sprecker, E.B., Operational analysis and measurements of tropospheric propagation as related to communication systems. US National Bureau of Standards, Report 3514, Jan. 1, 1954. Unchecked.

(57a) Hirao, K., What role does the nocturnal cooling play in the ultra-short wave propagation? Japan. Radio Research Laboratories, Journal, 1(1):27-39, 1954. Unchecked.

(58a) Kiely, D.C., Some measurements of fading at a wavelength of 8 mm over a very short sea path. British Institution of Radio Engineers, Journal, 14:87, 1954. The results of a pilot experiment designed to investigate the magnitude of atmospheric refraction effects in the 8 mm wavelength band are described. Records of the signal fading on a one-mile over-sea path with a low transmitter and a high receiver indicate that these effects are very large. Brit. IRE, abstract.

(59a) Meecham, W.C., A statistical model for the propagation of radiation in refraction ducts bounded by rough surfaces. (Thesis Univ. of Michigan 1955). Also published jointly as Technical Report 1936-3-T, Nov. 1954 by the Engineering Research Institute, Univ. of Mich. and by the Research Analysis Group, Brown Univ., Providence, R.I. DLC. Microfilm AC-1, No. 11, 324. (Unchecked)

(60a) Saxton, J.A., Radio-meteorology. Conference in Texas. Nature, London, 173(4408):761-764, April 24, 1954. DWB--Account of Conference on Radio Meteorology Nov. 9-12, 1953, Texas Univ., Austin. (See item 5.7-3, July 1954, MAB.) Under tropospheric wave propagation papers by T. J. Carroll on abnormal range, W. E. Gordon, on scattering of radio waves and by several authors on refractive index structure, were discussed, as well as papers on propagation research by the National Bureau of Standards, mapping and prediction of wave propagation. Other papers and discussions dealt with thunderstorm and tornado static, cloud and precipitation physics in relation to radar echoes and operational uses of weather radar in detection of storms, fronts and tornadoes, and possible use in forecasting. Some 60 papers were read. --C.E.P.B.

(61a) Silverman, Richard A. and Balzer, Martin, Statistics of electromagnetic radiation scattered by a turbulent medium. Physical Review, 96(3):560-563, Nov. 1, 1954. 6 eqs. Univariate and bivariate amplitude distribution are calculated employing Villars and Weisskopf's theory, and compared with experiment. The univariate distribution is Raleigh, and the bivariate is used to derive a relation between the amplitude correlation function and the velocity correlation function as appearing in von Weizsäcker-Heisenberg's statistical theory of turbulence.--W.N.

(62a) Villars, F. and Weisskopf, V.F., Scattering of electromagnetic waves by turbulent atmospheric fluctuations. Physical Review, 94(2):232-240, April 15, 1954. 2 figs., 7 refs., 54 eqs. Application of the statistical theory to tropospheric and ionospheric density fluctuations. The dominant role of humidity fluctuation in tropospheric scattering is relevant.--W.N.

1955

(63a) Ames, L.A.; Martin, E.J. and Rogers, T.F., VHF extra diffraction propagation bandwidth at 200 miles. U.S. Air Force Cambridge Research Center, Report TR-55-121, June 1955. Unchecked.

(64a) Ames, L.A. and Rogers, T.F., Available bandwidth in 200-mile VHF tropospheric propagation. Institute of Radio Engineers, Transactions, AP-3(4):369-373, Oct., 1955. Unchecked.

(65a) Austin, H.R. and Baker, R.E., Experimental investigation of mountain obstacle path transmission. Riverside, California, Motorola Inc., Nov. 1955. Unchecked.

(66a) Ayers, J.J. and Clement, W.D., Study and investigation of tropospheric scattering. Radio Corporation of America, Report No. CA-584-43, Aug. 15, 1955. Unchecked.

(67a) Barsis, A.P.; Herbstreit, J.W. and Hornberg, K.O., Cheyenne mountain tropospheric propagation experiments. US. National Bureau of Standards, Circular No. 554, Jan. 3, 1955. 39 p., 46 figs., 2 tables, 18 refs., eqs. Measurements at five frequencies from 92 to 1,046 Mc/s were conducted over 393 and 617 miles paths and reported on. The studies include effects of rough terrain, dependence of transmission loss on refractive index profiles, height gain functions and application of related theories e.g. the new theory of propagation embodying Booker-Gordon's scattering principles as extended by Staras.--W.N.

(68a) Batchelor, G.K., The scattering of radio waves in the atmosphere by turbulent fluctuations in refractive index. Cornell University, School of Electrical Engineering, Report No. EE-62, Sept. 1955. Unchecked.

(69a) Beverage, H.H., Laport, E.A. and Simpson, L.C., System parameters using tropospheric scatter propagation. Radio Corporation of America, Review, 16(3):432-457, Sept. 1955. 17 figs., 2 tables, 8 eqs.

(70a) Bray, W.J., Hopkins, H.C., Kitchen, F.A. and Saxton, A., Review long-distance radio wave propagation above 30 Mc/s. Institution of Electrical Engineers, Proceedings, (Pt. B,) Vol. 102:87-95, Jan. 1955. 3 tables, 61 refs., eqs.

(71a) Bullington, K., Durkee, A.L. and Misenheimer, H.W., Radio propagation tests. NEAC area. Final Report, March 1955. Bell Telephone Laboratories Inc., New York. Unchecked.

(72a) Carroll, Thomas J., Overcoming the line-of-sight Shibboleth with the air and high power. Institute of Radio Engineers, Convention Record, Pt. 1:121-125, 1954. Also: Institute of Radio Engineers (Australia), Proc., 16:107-112, April 1955. 3 refs. This paper gives a simple account of the reasons for both VHF and UHF trans-horizontal propagation and includes some probable implications for the UHF television. The role of the troposphere has been grossly neglected in the earlier tropospheric propagation theory. It is not in the shape of the

index profile, but rather in making proper distinction in the mathematics between the unhomogeneous air layer and the homogeneous void beyond which is the crux. --W.N.

(73a) Chambers, G.R.; Herbstreit, J.W. and Norton, K.A., Preliminary report on propagation measurements from 92-1046 Mc at Cheyenne Mountain, Colorado. U. S. National Bureau of Standards, NBS Report, No. 3520, Jan. 1, 1955. Supplement 4. 9 p. 17 refs., figs. DWB--A description is given of the facilities provided by the National Bureau of Standards on Cheyenne Mountain inColo. and in its vicinity which are used for the measurement of the transmission loss on radio transmission circuits operated in the frequency range from 92 to 1046 Mc. Some preliminary results of these measurements are presented, together with tentative theoretical explanations.--Authors' abstract. (Listed by title only as No. 488 in preceeding checklist.)

(74a) Chapman, H. and Crain, C. M., Characteristics of tropospheric refractive index fluctuations observed during a 1955 measurement program in the Colorado and Florida areas. Texas, Univ. Electrical Engineering Research Laboratory, Report No. 6-12, Oct. 31, 1955. Unchecked.

(75a) Crain, C. M., Airborne measurements of atmospheric refractive index microvariation up to 20, 000 feet over southeastern Colorado. Texas Univ., Electrical Engineering Research Laboratory, Report No. 5-11, 1955. Unchecked.

(76a) Crysdale, J.H., Dickson, F.H., Egli, J.J. and others, Large reduction of VHF transmission loss and fading by presence of a mountain obstacle in beyond-line-of-sight paths. Institute of Radio Engineers, Proc., 43(5):627-628, May 1955. 2 figs., 5 refs.

(77a) Davidson, David and Poté, Alfred J., Designing over-horizon communication links. Electronics, 28(12):126-131, Dec. 1955. 8 figs., 4 tables, 17 refs., 11 eqs. Long-distance, wide-band circuits are possible using the phenomenon of tropospheric propagation provided light transmitter power and diversity receiving equipment are used. Design considerations, including antenna gain and order of diversity, show how to set up a working system with a given percentage of reliability.--Authors' abstract.

(78a) Eckart, Gottfried, Statistische Beschreibung der dielektrischen Turbulenz in der Troposphäre. (Statistical presentation of dielectric turbulence in the troposphere.) Akademie der Wissenschaften, Munich. Math.-Naturwiss. Klasse, Abhandlungen, new ser., No. 74, 1955. 34 p. fig., 26 refs., 112 eqs.

(79a) Feinstein, Joseph, Information theory aspects of propagation through time-varying media. Journal of Applied Physics, 26(2):219-229, Feb. 1955. 3 figs., 1 table, 9 refs. 45 eqs. ≠ 3 app.

(80a) Fejer, J.A., Tropospheric scattering propagation and a theoretical study of transmission loss. South African Institute of Electrical Engineers, 46: Part 12, p. 348 - 363, p. 364 - 367, Dec. 1955. Unchecked.

(81a) Froome, K.D., The refractive indices of water vapor, air, oxygen, nitrogen, and argon at 72 kmc/s. Physical Society of London, Proc. Pt. B, 68(11):833-835, Nov. 1, 1955. 2 figs., 2 refs. Cavity resonator measurements at 72 kmc/s compared with those at lower frequency show that nitrogen and argon changed not, all the other components did as much as expected from dipole theory.--W.N.

(82a) Herbstreit, J.W.; Rice, P.L. and Sprecker, E.B., Survey of Central Radio Propagation Laboratory research in tropospheric propagation. U.S. National Bureau of Standards, NBS Report, No. 3520, Jan. 1, 1955. 127 p. plus 22 supplements, separately paged. Brief abstracts of 314 publications concerned with the NBS tropospheric propagation research program from beginning. Author index to these pubs. p. 116-117, Supplementary list of the 22 supplements (text of papers, or excerpts from papers). DWB--This report summarizes and abstracts publications concerned with the National Bureau of Standards tropospheric propagation research program dating back to the formation of the Central Radio Propagation Laboratory. Some technical papers are reproduced here as supplements to this report and excerpts from some of the longer technical reports are also included.--Authors' abstract. (Listed by title only as No. 508 in preceeding checklist.)

(83a) Hoffman, W.C., Scattering of electromagnetic waves from a random surface. Quarterly Journal of Applied Mathematics, 13:291-304, Oct., 1955. Unchecked.

(84a) International Radio Consultative Committee, Atlas of ground-wave propagation curves for frequencies between 30 Mc/s and 300 Mc/s (C.C.I.R. Resolution No. 11). Geneva, Union Internationale des Telecommunications, 1955. XXXV p. of text. 174 p. of charts. 10 refs. 3 column pages of French, English (original) and Spanish text. DLC (QC973.I55) This atlas is composed of 168 main diagrams for direct practical application plus 24 diagrams featuring typical physical properties. The earth is considered as smooth and spherical, homogeneous so far as electrical properties are concerned. The troposphere is stratified, while the gradient of the refractive index near the ground is based upon 4/3 times the actual value of the effective radius of the earth. No ionospheric influence is included. --W.N.

(85a) La Grone, A.H., Straiton, A.W. and Smith, H.W., Synthesis of radio signals on over-water paths. Institute of Radio Engineers, Transactions, AP-3(2):, April 1955. Unchecked.

(86a) Mack, C.L., Diversity reception in UHF long range communications. Institute of Radio Engineers, Proc., 43(10):1281-1289, Oct., 1955. 14 figs., 5 refs., 20 eqs.

(87a) Norton, K.A. and Janes, H.B., Rate of fading in tropospheric propagation. U. S. National Bureau of Standards, NBS Report, No. 3520, Jan. 1, 1955. Supplement 7. 6 p. 3 figs., 7 refs., 9 eqs. DWB--In this paper an analysis of tropospheric fading is presented. Fading rate is defined to be the number of times per minute that the envelope of the received field crosses its median level with a positive slope. It is shown that this definition of fading rate not only provides a quantity which is easily determined from the experimental data but also provides a quantity which is readily identifiable with the parameters of the propagation medium. It is shown that this definition is as useful in the intermediate range of distances where the scattered component of the received field is comparable to the diffracted component as it is at the larger angular distances where the scattered component predominates.--Authors' abstract. (Listed by title only as No. 533 in preceeding checklist.)

(88a) Rice, P.L. and Daniel, F.T., Radio transmission loss versus distance and antenna height at 100 Mc. U. S. National Bureau of Standards, NBS Report, No. 3520, Jan. 1, 1955. Supplement 8. 25 p. 11 figs., tables, 7 refs., 4 eqs. DWB--This report describes curves of transmission loss versus distance

and antenna height derived from an analysis of approximately 159,000 hourly median field strength observations between 90 and 110 Mc. These observations extend over a period of several years and are distributed geographically over the whole U.S. The curves contained in this report are believed to be more precise for engineering use than the FCC Ad Hoc Committee curves published in 1949, the only curves of this character generally available up to now.--Authors' abstract. (Listed by title only as No. 542 in preceeding checklist.)

(89a) Rice, P.L.; Daniel, F.T.; Mansfield, W.V. and Short, P.J., Radio transmission loss versus angular distance and antenna height at 100 Mc. U.S. National Bureau of Standards, NBS Report, No. 3520, Jan. 1, 1955. Supplement 9. 26 p. 11 figs., tables, 19 refs., 11 eqs. DWB--This report derives prediction curves of radio transmission loss and its long-term variability in time. The prediction parameters are angular distance and transmitting or receiving antenna height, with one antenna height fixed at 30 ft. The curves are based on observations of transmission loss over propagation paths in the area of the U.S. east of the Rocky Mountains, with data from the Pacific Coast shown for comparison. The basic data for the analysis reported here are hourly median values of transmission loss at frequencies between 92 and 108 megacycles.--Authors' abstract.

(90a) Roessler, E., Erklärungen für die beständigen Feldstärken unter 10m. Wellenlänge weit hinter dem Horizont. (Explanation of the prevailing field strengths below 10m wavelengths far beyond the horizon). Elektronische Rundschau, 9(4):151-155, 1955. 4 figs., 56 refs. This is a compressed survey of various theories and works on beyond-the-horizon propagation as conducted in USA, United Kingdom and Germany.--W.N.

(91a) Saxton, J.A. and Lane, J.A., Reception effects of trees and other obstacles. Wireless World. 61(5):229-232, May 1955. 3 figs., 4 refs.

(92a) Sherwood, E.M. and Ginzton, E.L., Reflection coefficients of irregular terrain at 10 cm. Institute of Radio Engineers, Proc., 43(7):877-878, July 1955. 13 figs., 4 refs.

(93a) Smith-Rose, R.L., Radio communication by wave scattering. Wireless Engineer, 32(11):287-290, Nov. 1955. Tropospheric and ionospheric works are discussed briefly along with experiments in the United Kingdom.--W.N.

(94a) Smith-Rose, R. L. and Saxton, J. A., U.H.F. television broadcasting: Study of propagation conditions: Geographical separation of stations using common frequencies. Wireless World, 61(7):343, July, 1955. 2 figs., 2 tables, 13 refs.

(95a) Tao, Kazuhiko, On the relationship between the hourly variation of field strength and the structure of the lower atmosphere. Japan. Radio Research Laboratories, Tokyo, Journal, 2(8):181-191, April 1955. 13 figs., table, 10 refs. DWB--It is clear that the relationship between the hourly variation of field strength and the distribution of the refractive index in the lower atmosphere is ascertained by the actual data from captive balloon observations, i.e., the high level of field strength corresponds to the abnormal distribution of the refractive index. Moreover, it is clear that the abnormal distribution of the refractive index can be explained from the view-point of synoptic meteorology.--Author's abstract.

(96a) Tolstoy, Ivan, Note on the propagation of normal modes in inhomogeneous media. Acoustical Society of America, Journal 27(2):274-277, March 1955. 2 figs., 8 refs., 24 eqs. This theoretical discussion includes equations and a method for attacking the problem of dispersion in ducts, and it is demonstrated how solutions for most cases encountered in nature can be solved.--W.N.

1956

(97a) Abild, B., UKW-Feldstärke als meteorologisches Element. (USW field strength as a meteorological element). Fernmelde Praxis, (1/2):25-32, Jan., 1956. From the well established functional correlation between weather and field strength is it not merely possible to derive the origin of the field strength fluctuation, but also to determine the state of the atmospheric layers from the characteristics of field strength. Field strength recordings will complement the random tests conducted by way of radio sonde ascends, thus constituting an integral of the weather in time and space, particularly distinct when fronts cross the path under measurements. Uniquely determined results of simultaneous observations over several lengths of paths are thus obtainable. Individual examples of weather analysis by means of field strength characteristics of the legs Schleswig-Hamburg and Schleswig-Hannover (117 and 242 km, 88.5 and 97.8 Mc respectively) are given. It is concluded that a network of meter waves will provide a detailed picture of humidity and other conditions in the lower layers of the atmosphere over a large region. Author's abstract (transl. from German).

(98a) Adey, A.W. and Heikkla, W.J., Microwave refractometer measurements of atmospheric refractive index. Paper presented at: Canadian IRE Convention, Toronto, Oct. 1-3, 1956. Unchecked.

(99a) Altman, Frederik J. (Int. Teleph. & Telegraph Corp.), Design chart for tropospheric beyond-the-horizon propagation. Electrical Communications, N.Y., 33(2):165-167, June 1956, fig., table. This chart represents a summary of several propagation data presently available and facilitates choice of equipment and the computation of carrier-to-noise ratio. The practical applicability of the curves is demonstrated by three sample computations tabulated. --W.N.

(100a) Altman, Frederick J. (Int. Teleph. & Telegraph Corp.), Configurations for beyond-the-horizon diversity systems. Electrical Communication, N.Y., 33(2):161-164, June 1956. 2 figs., 3 foot-refs. The recent application to beyond-the-horizon links of the dual-polarization method of exciting antennas has introduced a hitherto unexploited parameter to provide many as yet unused configurations. A systematic classification and nomenclature is described, and 26 systems, including those already well known, are derived from the elementary forms shown. From author's text.

(101a) Altman, Frederick J.; Gray, Richard E.; Kandoian, Armig G. and Sichak, William (all, Int. Teleph. & Telegraph Corp.), 900-megacycle pulse-time-modulation beyond-the-horizon radio link. Electrical Communication, N.Y., 33(2):143-150, June 1956. 12 figs. (incl. photos). Some results obtained with pulse-time equipment for the study of this propagation to multi-channel transmissions, are discussed. The experiments are conducted over a 2-way link, Nutley, N.J. - Southampton, Long Island, N.Y. It is concluded that ptm modulation retains its known properties when applied to transhorizontal propagation. The ptm equipment used is described and illustrated. --W.N.

(102a) Altman, Frederick J. and Sichak, Wm. (both, Int. Teleph. & Telegraph Corp.), Simplified diversity communication system for beyond-the-horizon links. Electrical Communication, N.Y., 33(2):151-160, June 1956. 15 figs., photo, 2 foot-refs., eqs. The 900 MC non-optical path transmission experiments as conducted between Nutley, N.J. and Southampton, Long Island, N.Y. by means of frequency modulation, frequency-division multiplex, and diversity reception are reported on here. Since the emphasis is on equipment economics and the analysis of diversity combining methods, the system is described in detail. --W.N.

(103a) Ament, W.S., Forward and back scattering from certain rough surfaces. Institute of Radio Engineers, Transactions, AP-4(3):369-373, July, 1956. 3 figs., 3 refs., 12 eqs.

(104a) Ames, L.A., Martin, E.J. and Rogers, T.F., Long distance VHF - UHF tropospheric field strength and certain of their implications for radio communications. Institute of Radio Engineers, Transactions, CS-4:102, March 1956. Unchecked.

(105a) Ames, L.A.; Martin, E.J. and Rogers, T.F., The possibility of extending air-ground UHF voice communications to distances far beyond the radio horizon. U.S. Air Force Cambridge Research Center, Report TR-56-111, June 1956. Unchecked.

(106a) Anderson, L.J. and Gossard, E.E., The effect of super-refractive layers on 50-5000 Mc non-optical fields. Institute of Radio Engineers, Transactions, AP-4, (2):175-178, April, 1956. 8 figs., 1 table, 5 refs. The measurements at 52, 100, 500 and 5,000 Mc/s were conducted at an 82 nautical mile link between San Diego and San Pedro. The relationship of observed radio fields to the vertical structure of the atmosphere is determined statistically. The results are compared with the results of the mode theory and agree well at about 100 Mc/s but departs considerably for other frequencies.--W.N.

(107a) Arnold, J. and Forbes, E.J., Study and investigation of tropospheric scattering. Radio Corporation of America. February 15, 1956. Unchecked.

(108a) Beard, C.I., Katz, I. and Spetner, L.M., Phenomenological vector model of micro-wave reflections from the ocean. Institute of Radio Engineers, Transactions, AP-4(4):162-167, April, 1956. 4 figs., 2 tables, 15 refs, eqs. The model is based on experimental data and fills a gap in the study of microwave reflection from water surfaces.--W.N.

(109a) Bolljahn, J.T. and Lucke, W.S., Some relationships between total scattered power and the scattered field in the shadow zone. Institute of Radio Engineers, Transactions, AP-4(1):69-71, Jan. 1956. Fig., 19 eqs. Equations are derived which relate the far-zone scattered field, as measured in the shadow zone of an electromagnetic scatterer, to the total energy scattered and absorbed by the scatterer, the energy stored in the fields about the scatterer is also related to the far-zone scattered field in the shadow zone.--Authors' abstract.

(110a) Carl, Helmut (C. Lorenz A.G.; Stuttgart), Range of multichannel radio links between 30 and 10,000 megacycles. Electrical Communication, N.Y., 33(2):168-173, June 1956. 8 figs. (incl. photo), 5 foot-refs. This paper was published in SEG-Nachrichten 3(4):185-187, 1955 and is the English version of the original title: "Die Grenzen der Reichweite von Richtfunkstrecken für Vielkanalübertragung im Frequenzgebiet von 30 - 10,000 MHZ". It reviews the 10-year evolution of communication from 30 to 10,000 Mc. It is concluded that the optical and the transhorizontal will continue to supplement one another for some future.--W.N.

(111a) Carroll, Thomas J. and Ring, Rose M., Optical and radio twilight and modes. Institute of Radio Engineers, Transactions, AP-4(3):580- July 1956. Abstract only.

(112a) Chu, C.M. and Churchill, S.W., Multiple scattering by randomly distributed obstacles - Methods of solution. Institute of Radio Engineers, Trans. AP-4(2):142-148, April 1956. 2 figs., 13 refs. Known methods are reviewed generally. Multiple scattering is considered from the Lagrangian and the Eulerian view points. Solution for several geometries by way of representing the intensity of components is shown. More accurate results than those obtained by way of the diffusion theory for anisotropic scattering are those yielded by the two-flux model developed. A six-flux model will increase accuracy but requires machine computations.--W.N.

(113a) Clara, José Maria (Nat. Telephone Co. of Spain) and Antinori, Albino (Ministry of Post Office and Telecommunications, Rome, Italy), Investigation of very-high-frequency non-optical propagation between Sardinia and Minorca. Electrical Communication, N.Y., 33(2):133-142, June 1956. 10 figs. (incl. photo), foot-ref. The experiments with frequencies from 238 to 297 Mc show that operational telephony is feasible in spite of the not too optimistic results discussed. On this 240 mi path only 1°/o or 88 hrs of the year the performance will be worse than 46 db adjusted, however, new techniques and instrumental improvements encourage further tests in process. The results are presented in graphs.--W.N.

(114a) Clavier, André G. (Int. Teleph. & Telegraph Corp.), Microwave communication beyond the horizon. Electrical Communication, N.Y., 33(2):108-116, June 1956. 6 figs., 18 refs. Some of the major facts contributing to reliable transhorizontal communication so far as design of equipment is

concerned are discussed here. Basic attenuation curves of practical value are given and transmission levels within and beyond the horizon as a function of frequency are presented in graphs. Fading margins in db related to wavelength from 6 - 300 cm are tabulated. --W. N.

(115a) Clavier, André G. and Altovsky, V. (both, Central Lab. of Communications, Paris), Beyond-the-horizon 3000-megacycle propagation tests in 1941. Electrical Communication, N. Y., 33(2):117-132, June 1956. 20 figs. (incl. photos), 2 foot-refs. The series of over-land-sea experiments with 10 cm waves were conducted around Toulouse, France from May to Dec. 1941 with equipment developed in war times and described here. Two different types of propagation were encountered viz (1) the normal, in turbulent atmosphere resulting in steady and rapid attenuation beyond the horizon, (2) the abnormal characterized by substantial increase of range beyond the horizon and large amplitude variations. The latter observation disagreed with the propagation theory in isotropic media. --W.N.

(116a) Crain, C. M. and Williams, C. E., Microwave refractometer predicts propagation. Electronics, 29(12):150-154, Dec., 1956. 6 figs., 8 refs. Changes in radio-wave propagation at the higher frequencies have been correlated with changes in refractive index of the atmosphere. Earlier investigations depended upon meteorological data collection and evaluation. The airborne microwave refractometer directly measuring refractive index profiles has become a powerful tool in propagation studies. --Authors' abstract.

(117a) Cullum, A.E., Jr., The application of modern techniques to the determination of service areas of television stations in smooth and in mountainous terrain. Paper presented at: Western Electronic Show and Convention, Los Angeles, Calif., Aug. 21-24, 1956.

(118a) Day, J. B. W., Crysdale, J.H. and Cook, W.S., An experimental investigation of the diffraction of electromagnetic waves by a dominating ridge. Paper presented at: Canadian IRE Convention, Toronto, Oct. 1-3, 1956. Unchecked.

(119a) Doherty, L.H., 2700 Mc/s scatter propagation between Ottawa and Toronto. Paper presented at: Canadian IRE Convention 1-3 Oct., 1956. Unchecked.

(120a) Eckart, Gottfried, Die Analyse der Störungen der Dielektrizitätskonstanten dielektrisch turbulenter Zonen mittels Streufeldbeobachtungen. Dritter Teil einer Theorie. (Analysis of disturbances of the dielectric constant of dielectric turbulent zones by means of observation of the field of scattering, Pt. 3) Akademie der Wissenschaften, Munich. Math.-Naturwiss. Klasse, new ser., No. 77, 1956. 18 p., refs., 44 eqs. The properties of a disturbance zone of the tropospheric dielectric constant which are extractable from scatter field measurements are investigated, also from a statistical view point. Author's Abstracts. (translated from German.)--W.N.

(121a) Eckart, Gottfried, Über die Streuung elektrischer Wellen an Zonen dielektrischer Turbulenz. Zweiter Teil einer theorie. (Scattering of electric waves in regions of dielectric turbulence, pt. 2.) Akademie der Wissenschaften, Munich. Math., -Naturwiss. Klasse, Abhandlungen, new ser., No. 76, 1956. 36 p., 7 refs., 107 eqs. The small fluctuations of the dielectric constant in a region of the troposphere are discussed in this investigation of transpassing electric waves. Statistical data of the scatter field in relation to the dielectric constant turbulence are computed. Author's Abstract (transl. from German.)--W.N.

(122a) Eggart, Jack, Nuclear weapons effects on communication systems. Paper presented at: Western Electronic Show and Convention, Los Angeles, California, Aug. 21-24, 1956. Unchecked.

(123a) Epstein, J. and Peterson, D.W., A method of predicting the coverage of a television station. Radio Corporation of America, Review, 12(4):571-582, Dec. 1956. The method described is applicable to various station locations. Entire radial line estimates are done in a few hours. The validity of the method is confirmed by practical example given.--W.N.

(124a) Fannin, Bob M., Line-of-sight wave propagation in a randomly inhomogeneous medium. Institute of Radio Engineers, Transactions, AP-4(4):661-665, Oct., 1956. 5 figs., 15 eqs. Single-scattering approximation is used in this study, embodying the statistical quantities of variance, correlation function, power spectrums, with stress on transition of ray treatment results to the scattering cross section results. The time and space dependency of the correlation function for the refractive index facilitates computation of the power spectrum.--W.N.

(125a) Friis, H. T., Crawford, A. B. and Hugg, D. C., A reflection theory far beyond the horizon propagation. Paper presented at Canadian IRE Convention, Toronto, Oct. 1-3, 1956. Unchecked.

(126a) Gall, Frederick, The cost of decibels. Paper presented at Canadian IRE Convention, Toronto, Oct. 1-3, 1956. Unchecked.

(127a) Gordon, William E., Refractive index data and predictions of scattered fields. Presented at Symposium on Present and Future Uses of Refractive Index Data for Radio Propagation Purposes. U.S. Air Force, Cambridge Research Center and Lincoln Laboratory, Sept. 6-7, 1956. Unchecked.

(128a) Grosskopf, J. and Vogt, K., Der Einfluss von Bodeninhomogenitäten auf die Funkbeschickung. (Influence of surface inhomogenities on deviation of direction finders.) Nachrichtentechnische Zeitschrift, 9(8):349-355, Aug., 1956. The surface properties of a site of radio receiver and transmission installations are most vital. These properties will affect the efficiency and the radiative distribution of the antennas and cause bearing errors of direction finding stations. Comparative measurements conducted within the circumference of a direction finder station of conductivity and of bearing errors yielded a linear relation between the maximum conductivity variation 6 max/ 6 min and the mean bearing error δ(6 max/ 6 min = 4 yields $\delta = 1^{o}$). Exterior reflectors such as cables and power lines showed bearing errors of 0.5^{o}, 10^{o}, and 20^{o} respectively caused by (1) an uncharged cable ending right below the station (2) charged with counter balance and (3) a traversing cable. Discontinuity points of conductivity yielded a maximum of 2^{o}. However, determination of the azimutal distribution of the direction finder deviation from conductivity measurements is only feasible under ordinary surface conditions. Author's abstract (Transl. from German). --W. N.

(129a) Grosskopf, J., Über den augenblicklichen Stand der Forschung auf dem Gebiet der tropospharischen Streustrahlung. (The present state of the research into the realm of tropospheric scatter radiation). Nachrichtentechnische Zeitschrift, 9(6): 272-279, June 1956. The purpose of this paper is to summarize the current salient contributions, particularly the American works in the October 1956 issue of the Institute of Radio Engineers, Proceedings. --W.N.

(130a) Hirao, K., Fading of ultrashort wave and its relation to the meteorological conditions. Japan. Radio Research Laboratories, Journal, 3(13):191-255, July 1956. Unchecked.

(131a) Jones, D.E., A critique of the variational method in scattering problems. Institute of Radio Engineers, Transactions, AP-4, (3):297-301, July 1956. 6 refs., 24 eqs. The equivalence of the variational method and Galerkin's method is presented. The reciprocity theorem is complied with in terms of it rather than introducing the variational principle.--W.N.

(132a) McGavin, R.E. and Maloney, L.J., A study at 1046 Mc/s of the reflection coefficient of irregular terrain at low angles of incidence. Paper presented at: Western Electronic Show and Convention, Los Angeles, Aug. 21-24, 1956. Unchecked.

(133a) Meecham, W.C., Fourier transform method for the treatment of the problem of the reflection of radiation from irregular surfaces. Acoustical Society of America, Journal, 28(3):370-377, May 1956. Unchecked.

(134a) Meecham, William C., A method for the calculation of the distribution of energy reflected from a periodic surface. Institute of Radio Engineers, Transactions, AP-5:581- , July 1956. Unchecked.

(135a) Millman, George H., Analysis of tropospheric, ionospheric and extraterrestrial effects on V.H.F. and U.H.F. propagation. General Electric Co. Electronics Div., Technical Information Series, R56EMH31, Oct. 6, 1956. 138 p., 68 figs., tables, 50 refs., numerous eqs. Photostat copy. DWB (M94.7 M655an)-- Effects of the atmosphere and extraterrestrial noise sources on the propagation of VHF and UHF radio waves are discussed. Relationships are derived for calculating refraction effects, time delays, Doppler errors, polarization changes and attenuation of radio waves traversing the atmosphere. These conclusions were reached: Refraction and time delay effects in the troposphere are independent of frequency and are a direct function of relative humidity in the air. In the ionosphere refraction and time delay errors, polarization shift and attenuation are inversely proportional to the square of frequency. The doppler frequency error in the troposphere is directly proportional to

frequency while in the ionosphere is inversely proportional to frequency. The theoretical total radiation from the quiet sun, in the radio frequency spectrum, is directly proportional to frequency raised to about the 0.755 power. The total flux density emanating from radio stars, Cassiopea and Cygnus, is inversely proportional to the frequency raised to the 0.81 power.--S.P.

(136a) Misenheimer, Harvey N., "Over-the-horizon" radio tests. Telephony, 151(5):22-24,38 Aug. 4, 1956. 7 figs. This is an account of a full year 1953-1954 investigation conducted in Newfoundland over land-sea-paths under different weather and transmission conditions at frequencies of 505 and 4,090 Mc. The results are presented graphically and include the influence of weather, snow and fog on transmission.--W.N.

(137a) Moler, W.F. and Arvola, W.A., Vertical motion in the atmosphere and its effect on VHF radio signal strength. American Geophysical Union, Transactions, 37(4):399-409, Aug. 1956. 10 figs., 5 refs., 6 eqs. DWB, DLC--The hypothesis is proposed that the vertical gradient of the refractive index is strongly affected by the vertical motion in the atmosphere. It is shown that changes in this gradient are due principally to changes in the moisture stratification and temperature lapse rate resulting from the vertical velocity and its horizontal gradient within the air mass. Mean radio signal strengths are plotted against the time position of 500-mb troughs and ridges relative to the radio link. A series of 500-mb charts is given, with the vertical velocity field obtained by the Sawyer-Bushby method. The vertical velocity over two radio links is compared with the signal strength. Cross-sections taken through several of the troughs illustrate the stratification changes on the forward and rear sides of the troughs due to vertical motion.--Authors' abstract.

(138a) Morrow, W.E., Ultra-high frequency transmissions over paths of 300-600 miles. Presented at Symposium on Scatter Propagation of New York. Sec. of IRE, New York, Jan. 14, 1956. Unchecked.

(139a) Morrow, W.E. Jr., Mack, C.L., Nichols, B.E. and Leonhard, J., Single-sideband techniques in UHF long-range communications. Institute of Radio Engineers, Proc., 44(12):1854-1873, Dec., 1956. 31 figs., 25 refs., 7 eqs.

(140a) Nasilov, Dmitrii N., Radiometeorologiia: radiometody v meteorologii. (Radiometeorology: radio methods in meteorology.) Moscow, Gosud. Izdat. Tekhniko-Teoreticheskoi Lit-y, 1956. 215 p. 50 figs., 19 tables, 160 refs. DLC (QC973.N2)--A technical scientific book for meteorologists, geophysicists and radio amateurs, covering the many aspects of the recent science of radio meteorology. In the introduction four methods of sounding the atmosphere are discussed: 1) aerological, 2) optical, 3) acoustical and 4) radio methods. Atmospherics (sferics), reflection of radio waves from the ionosphere, from water drops, and from refracting layers are discussed at great length in Pt. I. In Pt. II the physical basis for radio meteorology is discussed including the role of water drops, of atmospheric dust, etc. The relation between synoptic conditions over Eurasia and abnormal propagation conditions between points on the Eurasian Continent or between America and U.S.S.R. are treated in great detail with illustrations, tables and charts.--M.R.

(141a) Reza, F., Some topological considerations in network theory. Paper presented at: Western Electronic Show and Convention, Los Angeles, California, Aug. 21-24, 1956. Unchecked.

(142a) Rice, P.L., Scatter propagation. Paper presented at Canadian IRE Convention, Toronto, Oct. 1-3, 1956. Unchecked.

(143a) Ringöen, R.M., Detailed performance characteristics of communication circuits employing tropospheric scatter propagation. Paper presented at Canadian IRE Convention, Toronto, Oct. 1-3, 1956. Unchecked.

(144a) Saxton, J.A., Tropospheric scatter propagation. Wireless World, 62(12):587-590, Dec. 1956. 2 figs. This is a review of the latest theories as related to radio communication.--W.N.

(145a) Schensted, C.E., Approximate method for scattering problems. Institute of Radio Engineers, Transactions, AP-4 (3):240-242, July 1956. 3 figs., 16 eqs. Two examples of the method are given, viz (1) scattering by a half-plane and (2) by a circular disk. The solution of satisfying certain boundary conditions which was the purpose, is given.--W.N.

(146a) Smith, J.W., System design problems associated with VHF scatter circuits. Paper presented at Canadian IRE Convention, Toronto, Oct. 1-3, 1956. Unchecked.

(147a) Smith, W.R., Electronics in meteorology. Paper presented at: Canadian IRE Convention, Toronto, Oct. 1-3, 1956. Unchecked.

(148a) Straiton, A.W. and Tolbert, C.W., Measurement and analysis of instantaneous radio height-gain curves at 8.6 millimeters over rough surfaces. Institute of Radio Engineers, Transactions, AP-4(3):346-351, July 1956. 13 figs., 4 refs. The data analyzed and discussed were taken on a radio path over Lake Austin, Nov. 1954. A specific antenna system was constructed for obtaining portional height-gain curves in a very short time interval. The vector sum of the direct, a constant reflected, and a varying reflected wave may represent the fluctuation of the radio signal measured.--W.N.

(149a) Symposium on electromagnetic wave theory. Report of conference held June 20-25, 1955 at the University of Michigan. IRE, Transactions, AP-4(3):191-586, July 1956. This issue is devoted entirely to the symposium and contains: Boundary value problems of diffraction and scattering theory (19 papers). Forward and multiple scattering (9 papers). Antenna theory and microwave optics (10 papers). Propagation in doubly-refracting media (7 papers). Summaries of the panel discussions (5 papers). Appendix: Abstracts of the contributed papers. A-1 Scattering, diffraction and general mathematical papers (17 abstracts). A-2 Multiple scattering, scattering from rough surfaces, and transmission and reflection problems (10 abstracts). A-3 Wave guides, propagation, and slow waves and surface waves (10 abstracts). A-4 Ferrities, Plasma oscillations, and anisotropic media (8 abstracts). A-5 Antennas and microwave optics (8 abstracts.) Author index.--W.N.

(150a) Wait, J.R., The prediction of tropospheric propagation from meteorological data. Paper presented at Western Electronic Show and Convention, Los Angeles, California, Aug. 21-24, 1956. Unchecked.

(151a) Waterman, A.T. Jr., Bryant, N.H. and Miller, R.E., Some observations of antenna-beam distortion in trans-horizon propagation. Paper presented at: Western Electronic Show and Convention, Los Angeles, California, Aug. 21-24, 1956. Unchecked.

(152a) Wheelon, A.D., Near-field corrections to line-of-sight propagation. Institute of Radio Engineers, Transactions, AP-4 (3):322-329, July 1956. 1 fig., 7 refs., 53 eqs. This study deals with the restrictions imposed on transhorizontal propagation by the turbulent fluctuations of the troposphere's dielectric constant. The field equation describing the propagation is developed and the subsequent solutions are then used to calculate the rms phase error for an arbitrary path in the troposphere, including dimensional descriptions for the multipath, scattered amplitudes. The phase correlation between signals on two parallel paths show the role of overlapping antenna beams. --W.N.

1957

(153a) Ament, W.S.; Macdonald, F.C. and Ringwalt, D.L., Scatter propagation in thunderstorm conditions. U.S. Naval Research Laboratory, Report of NRL Progress, August 1957, p. 17-25. 7 figs., 2 refs. Abstracted from reprint. DWB (M01.81 U586sca)--In April and May of 1957, joint scatter propagation studies were made of continuous X- and L-band pulse transmissions from Cape Canaveral, Florida, toward Nassau, Bahamas. The ground-to-ground signals on the 263 naut mi path were continuously recorded by Univ. of Florida scientists, and the ground-to-air signals along the path were recorded in NRL's R5D Flying Laboratory. The R5D and four other research aircraft measured refractive index and other properties of the atmosphere along the path. Special meteorological balloon soundings were made by the Air Force Missile Test Center. Three other investigations, carried on simultaneously on the ground, took advantage of the well-monitored radio signals and meteorology and provided data supplemental to the primary radio-meteorological program. Frequent thunderstorms and frontal activity along the path caused rapid fading and multipath in the radio signals. A preliminary summary of the radio signal behavior is given in this article.--Authors' abstract.

(154a) Barsis, A.P.; Capps, F.M. and Norton, E.M., Survey of propagation characteristics of sea test range in vicinity of the Naval Air Missile Test Center, Point Mugu, (Progress Report, No. 4). U.S. National Bureau of Standards, NBS Report, No. 5052, March 15, 1957. 16 p. 18 figs., 5 refs. DWB--(Reports 1-3 as NBS Reports, 3531, April 1, 1955; 3572, March 9, 1956; and 5003, Aug. 10, 1956) Measurement procedures, discussion of expected results on the

basis of theoretical studies of the propagation paths, and meteorological characteristics were contained in an earlier Progress Report (No. 2). This report contains an evaluation of the radio data from a purely operational point of view, as well as an interpretation of the data by the use of available meteorological information derived from radiosonde data from ascents at San Nicolas Island and at Point Mugu Naval Air Station.--N.N. (Listed by title only as No. 643 in preceeding checklist.)

(155a) Barsis, Albrecht P. and Kirby, Robert S., Long distance tropospheric propagation measurements between North Africa and Spain, Pt. 1, Theoretical estimates, path description, and method of operation. U.S. National Bureau of Standards, NBS Report, No. 5067, (1957). 16 p. 17 figs. (incl. photos), tables, 7 refs. DWB--The Radio Systems Applications Engineering Section of the Radio Propagation Engineering Division, National Bureau of Standards, Boulder, Colorado has been requested to undertake a study of propagation conditions in the VHF and UHF band over a 200 mile path between Morocco and Southern Spain. The ultimate purpose of this study is to provide estimates of power requirements and other design data for a multi-channel communications system to be installed between the path terminals. Meteorological data obtained from the usual sources provide the basis for correlation studies between observed radio data and the commonly used atmospheric parameters. Details are written out in the paper.--N.N. (Listed by title only as No. 642 in preceeding checklist.)

(156a) Baur, K., Phasenverzerrung durch Bodeninhomogenitäten. (Phase distortion due to surface inhomogeneities.) Nachrichtentechnische Zeitschrift, 10(8):369-376, Aug. 1957. In a preparatory work of the establishment of a direction finder station it is imperative to survey the immediate locality. The attention in particular should be drawn to the surface, since it will affect the dielectric constant as a function of the local variation of the surface conductivity. This fact causes a local phase deviation from the normal value and contributes to a distorted result of the direction findings. Formulaes are developed to permit a definition of the property of the surface hence the criteria for selection of a location suitable for a direction finder station is given. Author's abstract (transl. from German.)

(157a) Beard, C.I. and Katz, I., The dependence of microwave radio spectra on ocean roughness and wave spectra. Institute of Radio Engineers, Transactions, AP-5(2):183-191, April 1957. Unchecked.

(158a) Berg, E., Phasenverhältnisse im Beugungsschatten in geschichteter Troposphäre. (Phase conditions in the refraction shadow in a stratified troposphere). Archiv der Elektrische Übertragung, (9):366-378, 1957. The solution of the wave equation for a super refractive troposphere as given here for a magnetic dipole employs the Whitacker's functions to permit the solution of the weak inhomogeneous and homogeneous atmosphere as treated separately by neglecting their respective constants. The obtained sequence development of the Green's function is adapted by way of the Watson's transformation. In the specific case of an infinitely conductive earth it is shown that for the appearance of atmospheric cavity conductors it is necessary at least to possess a real zero point The dependency of the wave length limit on the refractive index and on the height of the cavity conductors is demonstrated. Finally the phase regions and their displacement at the earth's surface are compared with those of the homogeneous atmosphere. Author's abstract (Transl. from German). --W.N.

(159a) Boudouris, G., Propagation troposphérique. (Tropospheric propagation.) Paris, Centre de Documentation Universitaire, 1957. 463 p. numerous figs., eqs., bibl. p. 459-463. Mimeo. The author has realized in his work a synthesis of present knowledge concerning the propagation of radioelectric waves. The work is composed of 7 parts which deal successively with: 1. Propagation of plane waves; 2. Theorems and general notions. Specific waves; 3. and 4. Propagation over a level continent; 5. Propagation over the spherical earth; 6. Propagation over a nonhomogeneous world. Influence of irregularities of the ground and obstacles; 7. Propagation in real troposphere (nonhomogeneous). --A.V.

(160a) Dymowitch, N.D., Die Ausbreitung von Meter- und Dezimeterwellen über einer unebenen Erdoberfläche. (Propagation of meter and decimeter waves over a rough surface of the earth.) Elektr. Fernmeldewes., 11(6):28-33, June 1957. A transcendent geometric-optical equation is developed for determination of the points of reflection upon a rough earth surface, particularly in the case of a sine-shaped rolling

surface. From this, the path difference among the direct beams can be ascertained. The deviation of the calculated reception field strength resulting from an optical treatment of the same problem considering mirage does not exceed 30°/o. The results show good agreement with those experimentally obtained at 95 Mc by Grosskopf. Author's Abstract (translated from German).--W.N.

(161a) Gerhardt, J.R., Refractive index and air temperature fluctuations--University of Texas. (In: Lettau, H.H. and Davidson, Ben. eds., Exploring the atmosphere's first mile. N. Y. Pergamon Press, 1957. Vol. 1:220-227. 5 figs., table, 7 refs., 2 eqs.) DWB--The author describes the microwave refractometer which measured the difference in the resonant frequencies of two nearly identical cylindrical cavities operating in the 3.2 cm. wave length region of the electromagnetic spectrum and the theory of the measurement of the absolute value of the index of refraction in microwave frequencies is reviewed. Graphical and numerical data on the normalized power spectra for simultaneous refractive index and temperature fluctuations, root-mena-square values and cross-correlation coefficient for selected nets of refractive index and air temperature variations are presented and analyzed.--I.L.D.

(162a) Gray, R.E., The refractive index of the atmosphere as a factor in tropospheric propagation. Institute of Radio Engineers Convention, Propagation Session, March 1957. Unchecked.

(163a) Gudmandsen, P. and Larsen, B.F., Statistical data for microwave propagation measurements on two oversea paths in Denmark. Acta Polytechnica, 213 (Electrical Engineering Series, Vol. 7, No. 7, 1957. Abbreviated versions also published in L'Onde Electrique, 37(362):507-511, May 1957 and in Institute of Radio Engineers Transactions, Vol. AP-5 (3):255-259, July 1957. The measurements were carried out on 6.4 cm and 17 cm wavelengths on two paths, 54 km and 82 km long, stretching over sea nearly East-West and starting at the same point. For the greater part of the measurements height-spaced receivers were employed. The bulk of the statistical data comprises distributions of field strengths for every day of measurement. Curves for single receivers and for diversity combinations of two receivers have been worked out. Distributions for every hour of a day as well as distributions of fade durations for a few days with special

propagation conditions have been obtained. A study of special fading phenomena with almost coinciding fade on the receivers in operation has been made.--Authors' Abstract.

(164a) Hansford, R.F. and Collins, R.T.H., Choosing radar wavelength. Wireless World, 63(4):188-193, April 1957. 11 figs., table, 5 refs., eqs. Comparison between a 10 cm and a 25 cm radar having the same bulk of equipment shows that the former offers 58°/o greater range of detection in clear weather, in addition to other advantages over the 25 cm radar. Attenuation in rain is no problem for either, however backscatter clutter influences a 10 cm radar more. --W.N.

(165a) Hines, C.A. and Crain, C.M., Overwater refraction index measurements from the sea surface to 15,000 feet. Institute of Radio Engineers, Transactions, AP-5, 161- , Jan. 1957. Unchecked.

(166a) Hirao, K. and Akita, K., A new type refractive index variometer. Japan. Radio Research Laboratories, Journal, 4(18):423-437, Oct. 1957. Unchecked.

(167a) Klinker, L., Weitere Ergebnisse von troposphärischen Driftbeobachtungen zur Frage des Fernausbreitungsmechanismus in Meterwellenbereich. (Further results on tropospheric drift observations on the subject of radio propagation mechanism in the meter wave range.) Zeitschrift für Meteorologie, Berlin, 11(10/11):339-344, Oct./Nov. 1957. 5 figs., 3 tables, 5 refs. DWB, DLC--In order to investigate the propagation conditions in the ultrashort wave region, 160 observations on tropospheric drift made with short waves were carried out at the Kühlungsborn Observatory. Of these observations, 130 could be compared with simultaneous aerological measurements at the Copenhagen-Castrup Station. The results of the study indicate that the partial reflections in the meter wave region constitute the exclusive propagation mechanism up to a distance of 500 km from the sender. Ultrashort wave propagation observations prove to be a good aid in continuous control by large geographic areas over the intensity of vertical transposition processes in the lower troposphere, in particular of the ground layer, since the intensification or attenuation of strata inhomogeneities become immediately visible in the intensity of the reflected field. Specific examples of drift observations accompanied by aerological observations are presented. --I.L.D.

(168a) Klinker, Ludwig, Experimentelle Untersuchungen zur Frage des Fernausbreitungsmechanismus im Meterwellenbereich. (Experimental investigations into the mechanism of the long-range propagation in the meter wave region.) Nachrichtentechnik 7(5):210-215, May 1957. 5 figs., 7 tables, 20 refs., 3 eqs. Observations of USW fading over 50 km to 400 km distances were conducted in the period of a year. It is shown that the fading ridges do not change significantly with the length of paths. No dependency of the fading ridges on the average velocity of tropospheric turbulence was found, whereas a close correlation was found with the vertical components of movement of the tropospheric inhomogenities. The diversity distance is dependent on the corresponding period of fading and fluctuates between 85 m to well beyond 400 m on a 180 km long path. During tropospheric drift measurements it was mainly the wind discontinuities present at the lower border of the free inversions that were detected. These results are not interpretable in light of the scattering theory. In the meter wave region it may well be that it is the partial reflection from layer inhomogenities to transmission distances of not less than 400 km which makes up the dominant mechanism of propagation. Author's abstract (Transl. from German). --W.N.

(169a) Knöpfel, W., Einige Vergleichsuntersuchungen der Wellenausbreitungsverhältnisse in Band II und IV. (Some comparative investigations of propagation conditions in the II-band and in the IV-band.) Nachrichtentechnische Zeitschrift, 10 (5):233-235, May 1957. In order to secure basic data pertinent in the planning of radio transmission networks, damping measurements in the IV-band were conducted beyond diffractive ridges and locations. The IV-band results show an average of 6 db position damping and of 12 db diffraction damping greater than those in the II-band. A greater transmission density and a considerably pitched radiation out-put will produce adequate supply. Author's Abstract (transl. from German). --W.N.

(170a) Kühn, Udo, Ein Beitrag zur Kenntnis der Ausbreitungsbedingungen bei 1,3 GHz nach Messungen an einer Übertragungsstrecke mit optischer Sicht. (Propagation conditions at 1.3 GHz over an optical path). Technische Mitteilungen des BRF. 1(1): 4-10, Oct., 1957. The powerful field strength interference as observed in a year over a 82 km long Dezi-relay-line at 1.3 GHz featured daily and annual variation. The results are compared with

meteorological parameters and show certain correlations between frequency of the fading and the intermixing of the lower atmosphere and the vapor pressure. Author's abstract (Transl. from German).

(171a) Kühn, Udo, Einjährige Feldstärkemessungen im UKW-Rundfunkband in Kolberg bei Berlin. (One-year field strength measurements in the ultra short wave radio band at Kolberg near Berlin.) Geofisica Pura e Applicata, Rome, 38:157-168. 1957. 13 figs., 12 refs. German and English summaries. DLC--The results of field strength measurements over some propagation paths in the frequency range from 88-100 Mc are presented. On the average, the lowest field strength could be observed in June and Dec. There was found a correlation between the temperature gradient at inversions and the field strength when using the average values of field strength and the single values. The correlation coefficient between the field strength and the temperature gradient at the inversions is a function of the length of the propagation path. In the same way the amplitude of the daily variation of field strength depends on the length of the propagation path; the values being a maximum at a distance of 200 to 300 km. With a coefficient of 0.49 there was found a good correlation between the field strength and the air pressure variation at ground level. As there also exists a correlation between the field strength and the temperature variations in the lower part of the troposphere, a better correlation coefficient of 0.58 was found when comparing the field strength with the air pressure variation and the variation of the temperature at the 700 mb level. There are given some diagrams of the field strength dependent upon the available air mass, the height of the 700 mb level a.o. Some diagrams present the field strength variation with varying temperature gradient on inversions. As to the field strength variation with distance there was found a curve which for more than 300 km is somewhat below this curve that was measured by the Kühlungsborn Meteorological Observatory. The curve showed somewhat higher values compared with one curve which was published in a document of the U.S. presented at the CCIR Assembly in Warsaw in 1956.--Author's abstract.

(172a) Mc. Craken, Leslie G., Ray theory vs. normal mode theory in wave propagation problems. Institute of Radio Engineers, Transactions, AP-5(1):137-140, Jan. 1957. Unchecked.

(173a) Marshall, J.S. and Gordon, W.E., Radiometeorology. Meteorological Monographs (American Meteorological Society), Boston, 3(12-20):73-113, July 1957. 26 figs. (incl. photos), 5 tables, bibliography p. 109-113, eqs. In this review of developments in radio meteorology during the five year interval 1951-1955, the authors discuss the following subjects: sferics system including the goniometer and cathode ray direction finder, recent research in atmospherics (the use of sferics in detecting tornadoes, wave form of sferics, etc.); radio field strength beyond the horizon, radio scattering by a turbulent atmosphere, internal reflection of the atmosphere for radio waves, the refraction index of the atmosphere for radio waves, synoptic weather and radio propagation, and optical paths, the precipitation patterns observed by radar including displays of rain-shower cells, snow generating cells and trails, meso-scale pattern, tornadoes and hail, synoptic scale phenomena and hurricanes, theoretical and specialized studies in weather radar such as the weather radar equation, size distribution and the correlation among precipitation parameters, shape coating and polarization of hydrometeors, attenuation, reflectivity as a function of dust and pollen, the bright band, cloud observation by radar, and angels and lightning.--I.L.D.

(174a) Megla, G., Anwendungsgrenzen der Überreichweitentechnik im drahtlosen Nachrichtenwesen (Limits of the applicability of beyond the horizon techniques to radio communication services.) Wiss. Z. Hochsch. Elektrot. (Ilmenau), 3(1):63-1957. The range of a USW and microwave connection beyond the horizon can be computed when the path is divided into two parts. The exponential damping of the optical part of the path is accurately computable by formulas given. A field strength formula is derived for certain transmission power, directional effect of the antenna wave length and distance. This formula is valid for a distance beyond the horizon up to three times that of the optical. Author's abstract (transl. from German).

(175a) Misme, Pierre (Centre Nat. d'Etudes des Telecommunications, Paris), Correlation entre le champ électrique à grand distance et un nouveau paramètre radio-météorologique. (Correlation between the long-distance electric field and a new radio-meteorological parameter.) U. S. National Bureau of Standards, NBS Report, 5530, Oct. 24, 1957. 11 p. 8 figs., 5 refs. (Appendix): Trans. into English by M. C. Thompson, Jr. and Ann Fails. 8 p. DWB (621.384 U585oo)--

To improve the correlation between received field strength and atmospheric refractive index the author modifies the latter by a coefficient of atmospheric stability. The correlation is tested on data furnished by the U. S. National Bureau of Standards (Dodge City) and found to be satisfactory. --G. T.

(176a) Pike, Julian M., Weather effects on radio wave propagation. (In: Decker, Fred W., et al., Instrumentation and techniques for Army weather observation. Oregon. State College, Corvallis. Dept. of Physics, Contract DA-36-039 SC-73186, 3d Quarterly Technical Report, 1957. p. 30-33. 3 figs., 11 refs., eqs.) DWB (M01 066i)--There is an intermittent dielectric constant variation in both the ionosphere and the troposphere that causes a wave bending in air quantitatively, hence a refractive index must be used in the mathematical calculation of the weather effects on radio wave propagation. Radio wave bending in the lower atmosphere has been satisfactorily solved. A record of two meteorological parameters, viz: the vertical rates of change of humidity and of temperature, have been found to be responsible for the variations in dielectric constants and the consequent bending of radio waves. --N. N.

(177a) Plank, Vernon G.; Cunningham, Robert M. and Campen, Charles F., Jr. (all, G.R.D., AFCRC), The refractive index structure of a cumulus boundary and implications concerning radio wave reflection. Weather Radar Conference, 6th, Cambridge, Mass., March 26-28, 1957, Proceedings, pub. 1957. p. 273-280. 5 figs., 3 tables, 4 refs., 3 eqs. DWB (M01.81 R124pc)--Refractive index measurements made during an aircraft pass through cumulus have been analyzed for the details of index fluctuation at the cloud boundary. The microstructure is described and an explanation suggested. A restrictive estimate of boundary region reflectivity is obtained, using current theory. --Authors' abstract.

(178a) Poeverlein, H., Eine einfache Theorie der Beugung von Radio-wellen jenseits des optischen Horizonts. (A simple theory of radiowave diffraction beyond the horizon.) Zeitschrift f. Angewandte Physik, 8(2):90-95, 1956. Transl. into English (15 p.) issued by U.S. Air Force Cambridge Research Center, as its AFCR-TR-116, Sept. 1957. (ASTIA Document, No. AD 1337 II). 2 figs., 3 tables, 15 refs., 9 eqs. Repeated application of Huygen's principle leads to a

field-strength formula for waves diffracted around the curved earth which is identical with the approximation of the Van der Pol-Bremmer theory. The ground constants enter through the consideration of the reflected waves, especially the reflected Huygens elementary waves. The influence of the ground can be expressed by a parameter which appears in the properly written Fresnel reflection coefficient of the ground. In order to have the diffraction theory valid, certain assumptions have to be fulfilled. Irregular inclination of the earth's surface of inhomogeneities of the atmosphere can make the theory more or less useless for the shorter wavelengths. Author's Abstract.

(179a) Poeverlein, H., Grosse Reichweiten von m-, dm- und cm-Wellen. (Long ranges of VHF, UHF, and SHF.) Zeitschrift für Angewandte Physik, 8(5):244-254, 1956. Transl. into English (30 p.) issued by U.S. Air Force Cambridge Research Center, as its AFCR-TR-57-117, Sept. 1957. (ASTIA Document, No. AD 133712). 8 figs., table, 63 refs. 24 eqs. This paper was dedicated to Geheimrat Zenneck on his 85 birthday. The main topics discussed are the diffraction around the earth and the refraction in the troposphere as causative agents for the just beyond horizon reception and its irregularities, typical for waves shorter than 10m. It is shown that the scattering cross section depends mainly on the vertical extension of the scattering centers. The integration would remain unchanged by horizontal extension, but would increase the field strength at reception point in direction of specular reflection; otherwise it would decrease. --W.N.

(180a) Rogers, G.L., An experimental verification of diffraction microscopy, using radio waves. Journal of Atmospheric and Terrestrial Physics, 11(1):51-53, 1957. 6 refs. DWB--A DC-3 airplane was flown over 3 spaced radio receivers at 4000 and 8000 ft and fading of 125 m radio wave length was recorded photographically. The amplitude of the main wave fluctuated from 97-103°/o of undisturbed amplitude, equivalent to a scatter of 0.09°/o of energy, but projected area of DC-3 is only 0.028°/o of Fresnel half-period zone. The 3-fold increase in effective projected area is attributed to conduction. --C.E.P.B.

(181a) Saxton, J.A., Scatter propagation and its application to television. Television Society, London, Journal, 8(7):273-July-Sept. 1957. 6 figs., 33 refs. Both ionospheric and

tropospheric scattering and the application to communication are discussed. Tropospheric UHF scattering is applicable to TV-communication up to some 300 km and is more promising than ionospheric scattering.

(182a) Schünemann, R., Über den Mechanismus der Ultrakurzwellenausbreitung jenseits des Horizonts. (Mechanism of USW propagation beyond the horizon.) Wiss. Z. Hochsch. Elektrotechn. (Ilemenau), 3(1):59-62, 1957. Field strengths up to 100 km distances are mainly controlled by refraction, whereas scattering is responsible for the daily variation and which was experimentally evidenced through the 68 Mc transmissions over 76 km discussed here. The results are presented in graphs. The tropospheric scattering is largely responsible for the 100 - 800 km propagation from where ionospheric scattering takes place up to about 2, 000 km. Experimental propagation curves for different frequencies accompanied by the explanation of the tropospheric and ionospheric scattering held in a simple non-mathematical language. The origin of scattering is largely due to atmospheric inhomogenities in the form of layers and cells. Author's abstract (transl. from German).--W.N.

(183a) Staras, H., Antenna-to-medium coupling loss. Institute of Radio Engineers, Transactions, AP-5(2):228, April 1957. Unchecked.

(184a) Tao, Kazuhiko, Atlas of radio wave propagation curves for frequencies between 30 and 10, 000 Mc/s, Japan. The Radio Research Laboratories. Jan. 1957. Unchecked.

(185a) Tao, Kazuhiko, Meteorological influences on the hourly median field strength of ultra-short waves in the diffraction region. Japan. Radio Research Laboratories, Journal, 4(16):155-254, April 1957. Unchecked.

(186a) Täumer, F. and Müller, K., Die Ausbreitung der Bodenwellen über inhomogenen Untergrund. (Propagation of ground waves over inhomogenous surfaces.) Technische Mitteilungen des BRF, 1(2):21, 1957. Exact analyses of the ground wave propagation over a homogenous plain or spherical earth have been made by several workers, but in practice this prerequisite is rarely met. Hence further development in relation to the practical application of empirical methods for determination of the ground wave propagation over inhomogenous surfaces have become imperative the last years. The

evaluation of the different methods here discussed ensues the possibility of an engineer-technical interpretation of the radio's supply range. Authors' abstract (transl. from German). --W.N.

(187a) Tolbert, C.W. and Straiton, A.W., Attenuation and fluctuation of millimeter radio waves. Institute of Radio Engineers, Proc., 45(3):374-, March 1957. Radio propagation measurements at a wavelength of 4.3 mm. over a 61-mile path between Pikes Peak and Mount Evans are reported. An estimate of the water vapor and oxygen absorption is made from the variation of the attenuation with moisture content. The spectra and rms of the fluctuations of the millimeter waves are compared to those of the 3.2 cm waves recorded simultaneously. Instantaneous signal levels of the two wavelengths during a shower are compared. The results of these measurements are interpreted in terms of various millimeter wavelength measurements previously made by this laboratory and others. IRE Abstract.

(188a) Troitzki, W.N., Über den Einfluss der Antennenrichtwirkung bei tropospärischer UKW-Fernausbreitung. (Influence of the direction efficiency of antennas on tropospheric USW long range propagation.) Elektr. Fernmeldewesen, 11(1):21-23, Jan., 1957. The author's earlier formula for the field strength related to tropospheric scattering beyond the horizon is here adapted to the antenna characteristics of the transmitter and the receiver. The evaluation of the influence of direction efficiency of the antennas shows a remarkable reduction of the field strength as soon as the total width of the direction lobe in the vertical plane becomes lesser than that of the angle between the horizontal beam of the transmitter and the receiver. Since the transmission increases due to intensified directivity, a compromise between the factors should be considered when antennas are chosen.--Author's abstract (Transl. from German). --W.N.

(189a) Trolese, L.G., Foreground terrain effects on overland microwave transmissions. Institute of Radio Engineers, Convention Record, Antennas and Propagation, 1957. See also: IRE, Proc., 45(3):374, March 1957. Small terrain irregularities can produce large variations in field strength. Measurements taken at 3300 and 9375 mc on a 46.3-mile nonoptical link demonstrate that proper antenna siting can increase the signal by 15 to 30 db. A method of making propagation measurements to determine the effect of terrain irregularities on microwave links is described. The coupling between atmospheric refraction and irregular terrain is discussed.--IRE Abstract.

(190a) Twersky, Victor, On scattering and reflection of electromagnetic waves by rough surface. Institute of Radio Engineers, Transactions, AP-5(1), Jan., 1957. Unchecked.

(191a) Wille, H., Ergebnisse von Ausbreitungsmessungen an einer 15 GHz-Strecke. (Data on propagation measurements over a 15 GHz path.) Siemens Entwicklungsberichte, 20: 226-227, Nov., 1957. The field strength of a 15 GHz radio transmission over a 44 km path was measured over a period of 642 hr. The transmitter and receiver set-up is described. Analysis of the frequency recordings shows 84 hr with interference fading. Selective fading was observed at 50 MHz when the field strength as caused by non-selective fading dropped 10 db below the median value. The interference fading by multiple path propagation was distinctly separable into fading due to water vapor and that of rain. Author's Abstract (Transl. from German).--W.N.

1958

(192a) Anderson, L.J. (Smyth Res. Associates, 3930 Fourth Ave., San Diego, Calif.), Tropospheric bending of radio waves. American Geophysical Union, Transactions, 39(2):208-212, April 1958. 7 figs., table, 2 refs., 8 eqs. DWB, DLC--A simple and accurate method is presented for computing the refractive bending of radio waves in the lower 100,000 ft of the atmosphere. A given refractive-index profile is approximated by a series of straight lines (layers of constant gradient) and the incremental bending computed for each layer. The method is applied to the 'standard' atmosphere, and total bending is plotted against the surface refractive index for various vertical angles of arrival from 0 to 1 radian.--Author's abstract.

(193a) Barghausen, A.F.; Janes, H.B.; Guiraud, F.O., et al., Measurements of the power spectrum of fading in tropospheric scatter propagation. U. S. National Bureau of Standards, NBS Report, No. 5575, May 22, 1958. 8 p. 9 figs., 4 tables, 3 refs. DWB (621.384 B251me)--A description of the transmission paths, equipment and measurements is given of the field intensity recordings made during January, March, April, November and December, 1957, at 1046 megacycles, on two different tropospheric scatter paths in Colorado and Kansas. Data from the seven periods selected for power spectrum analysis indicate an input of about 600 equally-spaced values of signal amplitude for each sample studied. The spectra were similar in shape.--N.N.

(194a) Bauer, John R. and Meyer, Janes H., (both, Lincoln Lab., Mass. Inst. of Tech.), Microvariations of water vapor in the lower troposphere with applications to long-range radio communications. American Geophysical Union, Transactions, 39(4):624-631, Aug. 1958. 6 figs., 14 ref., 5 eqs. DWB, DLC--Variations of water vapor in the troposphere are calculated from simultaneous airborne measurements of radio refractive index and temperature obtained respectively with a microwave refractometer and an aerograph employing a sensitive bead thermistor. The partial pressure of water vapor is calculated from the well-known equation

$$e(\text{mb}) \cong 2.7(n-1)T^2 - 2.1 \times 10^{-4}\ PT$$

where n is the refractive index; T is temperature, °K; and P is total atmospheric pressure mb. The method is applied to the investigation of the horizontal and vertical structure of water vapor associated with a thin inversion layer found near 9800 ft. pressure altitude. Evidence is offered for the vertical stability and absence of turbulent mixing of the air in the region of the inversion. When the reflection coefficient of the observed layer at radio wave lengths of 600 and 72 cm is computed at a range of 200 mi beyond the horizon, better than an order of magnitude agreement is obtained between the calculated and observed path losses at this range.--Author's abstract.

(195a) Bean, B.R. (Radio Met. Soc. Natl. Bur. of Standards, Boulder, Colo.), First meeting on radio climatology. Institute of Radio Engineers. Proceedings, 46(7):1425-1426, July 1958. eq. DWB, DLC--On Jan. 15, 1958, a meeting was held at the Bouler Laboratories of the National Bureau of Standards, to determine methods and standards for compilation of radio propagation indexes based on meteorological data. The U.S. NBS, Air Defense Command, Army Signal Radio Propagation Agency, Army Electronic Proving Ground, Navy Weather Research Facility, and Naval Electronics Laboratory were represented. Agreement was reached that constants $K_1 = 77.6$ and $K_2 = 4810$ should be used in expressions for refractivity in formula

$$N = \frac{K_1}{T}\left(P + \frac{K_2 e_s RH}{T}\right).$$

where P is station pressure (mb), RH-relative humidity, e-vapor pressure in mb at absolute past data for general use and these and all punched cards of N at the N.W.R.C. (Asheville)

should be sent to C.R.P.L. (Boulder). Calculations of radio-refractivity will be made from radiosonde data at N.W.R.C. and five years of daily observations for February, May, August and November will be minimum for radio climatology of a location.--M.R.

(196a) Bean, Bradford R., On the climatology of ground-based radio ducts. U.S. National Bureau of Standards, NBS Report 6029, Dec. 4, 1958. 14 p. 7 figs., 3 tables, 6 refs., 18 eqs. DWB 621.384 U585onc) -- An atmospheric duct is defined to occur when geometrical optics indicates that a radio ray leaving the transmitter and passing upwards through the atmosphere is sufficiently refracted that it is traveling parallel to the earth's surface. Maximum observed incidence of ducts was determined as 13°/o in the tropics, 10°/o in the arctic and 5°/o in the temperate zone by analysis of three to five years of radiosonde data for a tropical, temperate, and arctic location. Annual maximums are observed in the winter for the arctic and summer for the tropics. The arctic ducts arise from ground based temperature inversions with the ground temperature less than -25°C while the tropical ducts are observed to occur with slight temperature and humidity lapse when the surface temperature is 30°C and greater.--Author's abstract.

(197a) Bean, Bradford R. and Ozanich, A.M., Climatic charts of the surface refractivity for Germany. U. S. National Bureau of Standards, NBS Report, No. 5588, July 9, 1958. 8 p. 66 figs., 2 tables, 9 refs. DWB (621.384 B367cL)-- The significant role of meteorological data used in the prediction of radio field strengths at frequencies of 50 Mc and above is recognized. Radiosonde measurements have been used in the description of the effect of elevated superrefractive layers. In this report of climatic charts of the surface refractivity for Germany, eight weather stations submitted their meteorological data for this investigation from which values of the maximum annual range of monthly means were studied. A comparison of the annual and diurnal ranges of N_o in Germany is made with those from six U.S. weather stations. Figures are much higher in the U.S.--N. N.

(198a) Bean, B. R. and Thayer, G.D., A model radio refractivity atmosphere. U.S. National Bureau of Standards, NBS Report No. 5576, NBS Project 8380-11-8361, June 9, 1958. 88 p. 15 figs., 11 tables, 21 refs., 33 eqs. DWB--It has been noted that at least 50°/o of the total bending of a radio ray by the

earth's atmosphere takes place in the first kilometer above the earth's surface. It is also noted that the simple difference ΔN, between the value of the refractivity near the earth's surface N_s, and at one kilometer above the earth's surface, N_1, may be described by:

$$-\Delta N = N_s - N_1 = 7.32 \exp \{ 0.005577 N_s \}$$

A model of the vertical structure of N may be defined solely in terms of N_s by assuming a linear decay of refractivity in the first kilometer above the earth's surface, an exponential decay from N_1 to a point of constant refractivity at an altitude of 9 kilometers above sea level and a single exponential decay above 9 kilometers. This model atmosphere is in good agreement with the actual N structure of the atmosphere, particularly when considering long term means. A set of reference atmosphere are defined in terms of certain combinations of N_s, ΔN and the station elevation. The magnitude of the elevation angle errors and the radio range errors are evaluated for various values of N_s, initial elevation angles, and radio ranges. --Author's abstract.

(199a) Bean, Bradford R. and Thayer, G.D., On models of the atmospheric radio refractive index. U.S. National Bureau of Standards, NBS Report 6025, Nov. 21, 1958. 35 p. 19 figs., 3 tables, 23 refs., 30 eqs. DWB (621.384 U585onm) --Evaluation of atmospheric refraction effects on UHF-VHF radio propagation has long been accomplished with the convenient four-thirds earth concept of Schelling, Burrows, and Ferrel. This mehtod has proven particularly useful in evaluating performance of point-to-point radio communications systems. However, relatively new long-range applications have demanded a model of atmospheric radio refractive index more representative of observed refractive index profiles than the simple linear decay inherent in the four-thirds earth approach. This paper introduces two models of atmospheric radio refractive index which can be used to predict refraction effects from the value of the refractive index at the transmitting point. Both models offer considerable improvement over the four-thirds earth model. A new method of predicting radio ray refraction at very low initial elevation angles is introduced which utilizes both the initial value and the initial height-gradient of the refractive index over roughly the first 100 meters above the earth's surface. This method, which is dependent only upon the first two radiosonde reporting levels or simple tower measurements of the common meteorological element, results in a considerable improvement of the values of ray-refraction predicted by the model. --Author's abstract.

(200a) Bolie, V.W. (Iowa State College, Ames, Iowa), Electromagnetic propagation in an almost homogeneous medium. Australian Journal of Physics, Melbourne, 11(1):118-125, March 1958. 4 figs., 24 eqs. DLC--This paper concerns the development from Maxwell's electromagnetic equations of an equation of propagation in an almost homogeneous medium. The equation is applied to the problem of determining the secondary wave produced by an isolated Gaussian-shaped perturbation in the refractive index. An exact solution is obtained for points located on the axis of symmetry parallel to the direction of propagation of the incident primary wave. An approximate solution for points remote from the anomaly is obtained and its validity is compared with the more restricted exact solution. An interesting limit process is encountered in the derivation of the formula for the scattering cross section of the refractive index perturbation.--Author's abstract.

(201a) Boudouris, Georges (Lab of Atmospherical Phys., Fac. of Sc., Paris), Sur l'indice de réfraction de l'air, l'absorption et la dispersion des ondes centimétriques par les gaz. (On the refractive index of the air, the absorption and dispersion of centimetric waves by gases. Journal Scientifique de la Météorologie, Paris, 10(39):91-113, July/Sept. 1958. 14 figs., 11 refs., eqs. French, English and Spanish summaries pp. 91-92. DWB--This first paper describes the experimental apparatus used for studying the refractive index of the air, the absorption and the dispersion of centimetric waves by gases under intermediate pressures (0 to about 1 atmosphere). Results obtained will be presented and discussed in subsequent articles. The author gives the fundamental theory of the instrument used and in particular the theory concerning the absorption measurements by electronic shifting of canals and differential dispersion measurements. He shows the setting and gaging of the instrument, its sensibility, stability and precision. The apparatus is a spectrograph using cavity resonators; its remarkable performances are essentially obtained by application of a pulse technique for the interpretation of cavity responses. The instrument has a high sensitivity (10^{-8} for the refractive index, 10^{-6} neper/m for the absorption) and the measurements are precise (about 0, 03 to $2^{o}/o$), stable and reproducible.--A.V. and Author's abstract.

(202a) Dinger, H.E.; Garner, W.E.; Hamilton, D.H., Jr. and Teachman, A.E., Investigation of long-distance overwater tropospheric propagation at 400 mc. Institute of Radio Engineers, Proceedings, 46(7):1401-1410, July 1958. 15 figs., foot-refs. DWB, DLC--The results of an investigation of

overwater tropospheric propagation under both summer (July, 1955) and winter (Feb., 1956) conditions are presented. Transmissions were from a point on the south shore of Massachusetts, near New Bedford, to a ship traveling along Great Circle courses to a maximum distance of 630 naut mi (724 statute mi) from the transmitter. A 10-kw, 385.5-mc transmitter feeding a 28-ft paraboloid antenna was used for the summer phase. For the winter investigation, this same facility was used, supplemented by a 40-kw transmitter feeding a 60-ft paraboloid for use at the greater distances. The frequency used for the winter was 412.85 mc. The receiving antenna aboard the ship was a 17-ft paraboloid for both series of tests. All antennas were horizontally polarized and approximately 100 ft above sea level. The data obtained are presented to show the median path loss vs. distance. The strip chart recordings of the received signal levels were analyzed with respect to fading characteristics in an effort to separate out those transmissions which were enhanced by super-refractive conditions. The fast fading signals, which were well-represented by the Rayleigh distribution, were assumed to be unaffected by superrefractive conditions. The data for the fast-fading Rayleigh type signals appear to show a cyclic variation of the attenuation rate with distance although there is no substantial deviation from a linear rate of between 0.16 and 0.18 db per nautical mile.--Authors' abstract.

(203a) Dropkin, Herbert A., Direct reading microwave phasemeter. IRE National Convention Record, Pt. 1-6:57-63, 1958. 8 figs., 9 refs. An instrument for rapid measurements of the phase properties of microwave networks is described and discussed. Adjusted to a single frequency 1^{o} phase measurements are feasible. The method is applicable for general use and at other microwave frequency ranges.--W.N.

(204a) du Castel, François; Misme, Pierre and Voge, Jean, Réflexions partielles dans l'atmosphère et propagation à grande distance. Première partie : Mesures météorologiques par P. Misme. (Partial reflection in the atmosphere and long-distance propagation. First part : Meteorological measurements by P. Misme.) Annales des télécommunications, Paris, 13 (7/8):209-214, July/Aug. 1958. 11 figs., 7 refs. DLC. The author starts by giving a brief survey of the theories susceptible of bringing an explanation of the

electric field observed from a long distance outside the visibility zone. By so doing the author brings out the idea that each theory is valid for a certain particular atmosphere model. Afterwards he presents the results of measurements taken in France and other foreign countries, which reveal layers characterized by sudden variations of the refractive index: he gives them the name of "feuillet" (leaflet). These "feuillets" seem to be in permanent existence in all parts of the globe, but their characteristics vary according to their meteorological situation. --A.V.

(205a) Eckart, G., Über die Polarisationsdrehung elektrischer Wellen in inhomogenen isotropen Dielektriken unter besonderer Berücksichtigung der Tropospäre. (Note on the polarization rotation of electrical waves in inhomogeneous isotropic dielectrics with particular reference to the troposphere.) Zeitschrift für angewandte Physik, 10(8):393-395, Aug. 1958. The rotation of polarization as observed in UHF communication whose propagation path is through the troposphere is discussed. Considering the known tropospheric inhomogeneties it is shown by use of Maxwell's equations that it does not occur and some reasons why it does not are given. Author's Abstract (translated from German).

(206a) Edmonds, Frank N., Jr., A comparison of observed amplitudes of tropospheric index of refraction fluctuations with those calculated from observed median transmission losses. Texas. Univ. Electrical Engineering Research Lab., Contract AF 19(604)-2249, Report No. 6-25, Aug. 15, 1958. 20 p. 2 figs., 14 refs., 39 eqs. DWB (M94.7 T355r)--In a companion report (EERL Report No. 6-24), a mathematical description of the index of refraction fluctuation field over Camp Carson, Colorado was obtained from airborne refractometer measurements made on March 8 and 9, 1955. This representation was given in terms of the power spectra of the fluctuations as a function of frequency of the index fluctuations and of altitude. In the present report, a formula derived from scatter propagation theory and based on the measured fluctuation spectra, is given which relates radio transmission loss to the square of the amplitude of the refractive index fluctuations. Using this relationship, a value of the square of the index fluctuations was calculated which would account for the mean radio signal level on each of 14 National Bureau of Standards radio paths originating in the Camp Carson area. The path lengths varied from 97 to 226 miles. The measured index of refraction parameter is

approximately the same as that required to explain the radio signal strengths on the shorter paths could conceivably be in the diffraction field. The measured index fluctuations are much greater than those required to explain the radio signal levels at greater distances. A possible explanation of this discrepancy is that the meteorological conditions adjacent to the mountains may not be representative of those on the plains farther east. The data needed to confirm this possibility, however, are not available. The need for a more comprehensive test is indicated.--Author's abstract.

(207a) Edmonds, Frank N., Jr.; Bostick, F.X., Jr. and Gerhardt, J.R., Power spectra evaluations for selected airborne microwave refractometer recordings. Texas. Univ. Electrical Engineering Research Lab., Contract AF 19(604)-2249, Report No. 6-24, Aug. 15, 1958. 2t p. appendixes. figs., and graphs, 22 refs., eqs. DWB (M94.7 T355r)--Fifteen samples of tropospheric index of refraction fluctuations have been analyzed statistically to give a description of the fluctuation field which is then interpreted in terms of current theories for the production of these fluctuations. The samples or shots were measured with an airborne microwave refractometer over Camp Carson, Colorado at altitudes ranging from 6500 to 20,000 feet above mean sea level. The analysis used improved equipment and techniques developed at EERL and yielded a power spectrum, an amplitude distribution plot and a running rms for each sample which are presented in Appendix I. A mathematical representation of the variation of the amplitude of the variations with frequency and with altitude has been obtained for the power spectra of the samples. This representation supports the universal equilibrium theory rather than the mixing-in-gradient theory for the production of the fluctuations by turbulence; it questions the use of Gaussian, exponential and modified Bessel correlation functions to describe the fluctuation field, and it emphasizes the critical role of meteorological factors in determining this representation. A discussion of the effects of molecular diffusion, tests for determining whether correlation functions can be associated with a given power spectrum, an investigation of how representative the 15 samples are of average conditions in southeastern Colorado, and a meteorological discussion of the variation of power spectra with altitude are attached as appendices to this report.--Author's abstract.

(208a) Gough, M. W., Diurnal influences in tropospheric propagation. Marconi Review, London, 21(131):198-212, 1958. 8 figs., 14 refs. DLC--The existence of diurnal variations in the signal strength of very short waves has considerable scientific interest. As is now well appreciated, the basic cause of these variations is the nocturnal cooling of heated land by radiation when the sky is clear, which gives rise during the night and early morning to pronounced atmospheric stratification near the ground. After a brief historical survey of observations of these effects, this article appraises the results of 80 Mc/s signal strength recordings maintained for six months over a 137 km non-optical path in the Persian Gulf, where the phenomenon occurred to a noteworthy degree. Modified refractive index profiles derived from selected upper air soundings made near the radio path have shown a clear association between (a) very weak signals and an approximately standard atmosphere and (b) very strong signals and the presence of pronounced elevated or ground-based inversion layers. Measured and theoretical signal strengths are compared on the basis of a uniformly graded atmosphere, reflection at an idealized elevated inversion layer, and propagation within a duct as treated by Booker. Finally, an analysis is made of M-profiles exhibiting the presence of ground-based ducts, which were found to be associated with high signal levels over the test path. It is shown that in twelve out of nineteen instances, trapping of the first transmission mode was taking place on a wavelength of 3.75 m. These observations, made in exceptional climatic conditions, provide evidence of recurrent nocturnal trapping on a wavelength which is perhaps longer than has hitherto been considered possible. --Author's abstract.

(209a) Graf, Calvin R. (U.S.A.F., San Antonio), Lightning enhancement of a VHF tropospheric scatter signal. Institute of Radio Engineers, Proceedings, Pt. I, 46(5):915, May 1958. ref. DLC--Observations of enhancement of TV tropospheric scatter signals each time a lightning is seen are reported and details of the phenomenon and accompanying circumstances are described. The observations were made in San Antonio, Tex. with video signals received from Houston and Midland, 200 and 300 miles distant. --G.T.

(210a) Hay, D.R., Air-mass refractivity in central Canada. Canadian Journal of Physics, Ottawa, 36(12):1678-1683, Dec. 1958. 2 figs., table, 15 refs., eqs. DWB, DLC--A study

of air temperature, humidity, and pressure profiles above Maniwaki, Quebec, for the year 1957 shows that the four types of air masses have distinctive refractivities. It is shown also that the air masses may be identified through their dry and total refractivities. For a typical air-to-ground communication path, the mean effective-earth's radius varies from 1.26 to 1.37 times the true radius for the four types of air mass.--Author's abstract.

(211a) Kennaugh, E. M. and Cosgriff, R. L., The use of impulse response in electromagnetic scattering problems. IRE, National Convention Record, 6 Pt. I:72-77, 1958. 7 figs., 2 refs. Nearly exact solution to electromagnetic scattering problems for any source frequency by an approximation to the impulse response of the scatterer is illustrated for several types of scatterers. Comparison of this novel method described is made with results as obtained by standard methods.--W. N.

(212a) Kühn, U., Ausbreitungsuntersuchungen über unterschiedlichem Gelände in den Frequenzbändern I, II, und III. (Investigations of the propagation in the frequency bands I, II and III over a variety of terrains). Technische, Mitteilungen BRF 2(1):1-7, Febr., 1958. This is a report on the results as obtained of extensive field measurements over different types of landscapes. The results are employed for determination of the dependency of the mean field strength on distance. The major purpose was to investigate the local scattering from different grounds and simultaneously to ascertain the dependency of frequency on the local scattering, the latter presented in graphs for the I, II, and III-bands respectively. For each of the recorded profiles the frequency statistics were evaluated showing a log-normal distribution of the different grounds and frequencies. The frequency distribution of the individual bands are presented; summarized for uniform terrains. This is shown to be a simplification so far as computation of power supply for TV and USW radio transmission is concerned. However, the landscape contingent differences as well as the frequency dependency on local scattering are relevant. Author's abstract (Transl. from German).--W. N.

(213a) Maenhout, A., Troposferische voortplanting van drie metergolven in verschillende luchtmassas. (Tropospheric propagation of 3-meter waves in different air masses.) Vlaamsche Academie voor Wetenschappen, Letteren en Schoone Kunsten van België. Klasse der Wetenschappen, Mededeelingen, 20(2), 1958. 16 p. 4 figs., 6 tables, 12 refs.

Dutch and English summaries p. 15-16 -- The signal strength from F.M. radiotransmitters, with wave length of approximately 3 m, was measured at the Geophysical Centre at Dourbes (Belgium). We tried to find relationships between the received signals and the air mass. The experimental results can be summarized as follows: a high signal strength is found in maritime weather situations, in air of tropical origin and in continental weather situations, when subsiding maritime air lies above continental air. In polar maritime air and in frontal zones, signal strengths are weak. The signal strength in maritime air is higher than in polar maritime air but generally lower than in maritime tropical air. A correlation was found between the signal strength in these different air masses and the static stability of the air mass. --Author's abstract.

(214a) Moyer, Vance E. and Gerhardt, J.R., Preliminary climatology of refractive index layer characteristics, Pt. 1, Southwest Ohio (and) Washington Coast. Texas. Univ. Electrical Engineering Research Lab., Contract AF 19(604)-2249, Report No. 6-26, Nov. 1, 1958. 25 p. 10 figs., tables, 16 refs. DWB (M94.7.T355r)--In an effort to establish forecasting systems involving the effects of atmospheric refractive index distribution on microwave propagation, a number of climatological and synoptic-climatological surveys of refractive index patterns have been made using radiosonde data. Although not without practical utility, the results so obtained suffer severely from the large lag inherent in the slow response sensing elements employed in the radiosonde and, thus, are able to give very little information on the detailed structure of marked atmospheric layers which can result in critically significant propagation effects. Although a general refractive index climatology employing the much more sensitive microwave refractometer is not as yet possible due to its hitherto limited operational employment, a sufficient backlog of such data has been obtained to warrant the initial processing of such a climatology for restricted times and geographical areas. This report presents the results of preliminary statistical evaluations of the heights, thicknesses, and intensities of significant atmospheric layers over two such geographical areas: vis., Southwestern Ohio and over the off-shore waters of the State of Washington. These evaluations are given in terms of frequency distributions accompanied, where possible, by gross correlations with synoptic-scale meteorological, climatological, and geographical properties.--Authors' abstract.

(215a) Ortwein, N.R., An annotated bibliography of literature pertinent to tropospheric scatter propagation, 1945-1957. U. S. Navy Electronics Laboratory, San Diego, Calif., Research Report 858, Aug. 4, 1958. 28 p. 118 refs.--Bibliography covers theoretical and experimental work on tropospheric scattering, beyond the horizon scattering, meteorological aspects and instrumentation. About 120 items are included, many with brief annotations. Items are arranged chronologically and an author index is appended.--M.R.

(216a) Rice, P.L.; Longley, A.G. and Norton, K.A., Prediction of the cumulative distribution with time of ground wave and tropospheric wave transmission loss. U. S. National Bureau of Standards, NBS Report, No. 5582, June 30, 1958. 81 p. 44 figs., 7 tables, refs., eqs. throughout. DWB (621.384 R497pr), -- A method of predicting the cumulative distribution with time of ground-wave transmission loss at frequencies above 10 mc per second over paths of arbitrary length is described. With available information about terrain profiles, and with surface meteorological data this method is a success since terrain irregularities, climate and weather are important factors in determining the strength and fading properties of a tropospheric signal. The procedure is outlined herein.--N.N.

(217a) Rider, G.C., Propagation measurements at 858 Mc/s over paths up to 585 km. Marconi Review, London, 21(131):194-197, 1958. 13 figs., 2 tables, 8 refs. DLC--The tests described in this paper have been made over five paths in Great Britain during the last two and a half years. The objective was to obtain the "know-how" in the application of the tropospheric scatter mode of propagation. The paths investigated have been progressively increased in length up to a total distance of 585 km. The mean diurnal variations of signal are presented for three paths, and their significance is discussed in relation to meteorological conditions. The effect of mean refractive index gradient upon median signal levels is examined. A good correlation is found between the presence of low signal and a polar air mass over the propagation path. The fading ranges and rates measured over the 322 km path are presented in some detail, and the correlations -- positive between fading rate and wind velocity, and negative between signal level and wind velocity -- are discussed. The obtrusive signal flutter attributed to aircraft is also considered.--From author's abstract.

(218a) Rowden, R.A., Tagholm, L.F. and Stark, J.W., A survey of tropospheric wave propagation measurements by the BBC 1946-1957. Institution of Electrical Engineers, Proceedings, Pt. B, 105, Supplement No. 8, Jan. 1958. Unchecked.

(219a) von Rautenfeld, F., Zur statistischen Auswertung von Feldstärkemessungen. (Statistical analysis of field strength measurements). Rundfunktechnische Mitteilungen 2(4):178-180, Aug., 1958. The basic features of a device for storage of several statistically different units of measurements are described. The instrument is applicable with the conventional magnetic sound tapes. The advantages over the graphical recording curves on paper are: universal possibilities of storage of material and text, chronological preservation of correlation in unit time, and by full-automatic analysis and re-use of the tape. Also briefly commented upon is a novel computer which simultaneously renders frequency distributions, total frequencies and the correlation of several units of measurements and prints the results in per cent figures. Detailed particulars of the latter instrument are to appear in later issues of this magazine. Author's abstract (Transl. from German).--W.N.

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(220a) Bean, Bradford R. and Riggs, L. P., On the synoptic variation of the radio refractive index. U. S. National Bureau of Standards, NBS Report, 6034, Jan. 13, 1959. 13 p. 30 figs., 11 refs., 5 eqs. DWB (621.384 U585ons)--The synoptic variation of the atmospheric radio refractive index, evaluated from standard weather observations, is examined during an outbreak of polar continental air. It is found that the reduced-to-sea-level value of the refractive index is a more sensitive synoptic parameter than the station value. The reduced value is quite sensitive to the humidity and density structure of the storm under study while the great station elevation dependence of the station value tends to mask synoptic changes. The reduced value changes systematically with the approach and passage of the polar front wave. The present system showed a consistent increase in the warm sector of the wave and a marked decrease behind the cold front.--Author's abstract.

(221a) Bean, B.R.; Riggs, L.P. and Horn, J.D. (all, Nat. Bur. of Standards), Study of the three dimensional distribution of the radio refractive index. U.S. National Bureau of Standards, NBS Report, No. 6042, Feb. 20, 1959. 8 p. 13 figs., 15 refs. DWB--An analysis of the three dimensional structure

of an intense outbreak of continental polar air is presented in terms of the radio refractive index of the atmosphere. Employed for the first time is a reduced index analogous to potential temperature. The reduced value more clearly shows the refractive index structure than the classical methods used heretofore. This new unit is a measure of both atmospheric density and humidity and shows, on a single cross-section, the air mass structure and the dynamic mixing of air around the frontal interface.

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